FORM NUMBER: #85-196-12
DATE: 7/81
REVISED: 12/30/85

WARREN//SHERER

INSTALLATION & OPERATION MANUAL

MODEL:

DUAL METIC AND TRI METIC

THIS REFRIGERATOR CONFORMS TO THE COMMERCIAL REFRIGERATOR MANUFACTURERS ASSOCIATION HEALTH AND SANITATION STANDARD.
CRS-SI-78

WARREN//SHERER
DIVISION OF KYSOR INDUSTRIAL CORPORATION

1600 ROCKDALE INDUSTRIAL BLVD., CONYERS, GEORGIA 30207 / 404•483•5600

THE WARREN/SHERER PARALLEL COMPRESSOR SYSTEMS

The advantages of parallel refrigeration systems are well known and accepted in the industry for their past performances. The simplicity and compactness of design make the addition of hot gas defrost and/or heat reclaim a simple and economical feature. The most important point in planning an installation of the Warren/Sherer Parallel System is the proper selection of the optimum systems for the particular application.

The selection and design of the system is based on the needs of the individual customer. This information must be passed on to the application engineer and must be complete and accurate. Due to the individuality of each customer and his needs, it is therefore impossible to categorize the Parallel System. The customer must make his needs known to the Regional Manager, and he in turn must be sure this information is passed on to the application engineer, who will in turn design the system.

Component parts have been selected for their dependability and availability to keep service problems to a minimum. Simplicity of design has also made the Warren/Sherer Parallel System one of the easiest to service and install.

12/30/85

RECEIPT AND INSPECTION OF EQUIPMENT

Inspect the Parallel System and any accessories shipped with them for damages or shortages before and during unloading. If there is any damage, the carrier should be notified immediately and an inspection requested. The delivery receipt must be noted that the equipment was received damaged. If damage is of a concealed nature you must contact the carrier immediately or no later than three (3) days following delivery. It is the responsibility of the consignee to file all claims for damage with the transportation company.

NOTE: Accessory items, such as drier cores, mounting pad, etc. are packaged in a separate carton. Be sure that you receive all items.

LIFTING INSTRUCTIONS

The Parallel System is a heavy piece of machinery and careful considerations of lifting procedures should be made before the unit is lifted by any means. The only part of the unit designed to carry any of the lifting load is the base. The unit may be lifted at the base with a forklift or by means of cables at the four corners of the base. If cables are used the lifting cables should be prevented from contacting any of the unit piping or electrical components.

In the following pages will be found explanations of system components, wiring and piping diagrams, control settings, and operational guides. Any additional information may be obtained by calling the Regional Manager in your area or contacting the Warren/Sherer plant in Conyers, Ga.

LOCATION OF EQUIPMENT

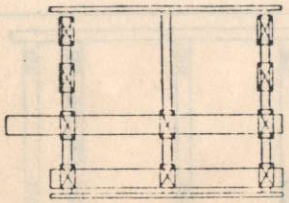
The Parallel Systems must be located so they are level and easily serviced. A minimum of 30" service clearance between units and any other walls or stationary equipment is recommended. For Parallel System units placed end to end 18 inches between units is adequate. The Parallel System is designed so that all pressure regulating valves can be adjusted from the front of the unit should installation in an outdoor machine house be desired or if machine room size necessitates sacrificing service. The machine room ventilation system should provide for approximately 100CFM of air flow for each compressor horsepower. The air intake should be positioned so that air flow passes over the units.

Vibration Mounts

Vibration pads are supplied with each unit, if optional isolator springs are not ordered. Quantities of vibration pads or isolator springs and the recommended placing is shown on pages 3 and 4.

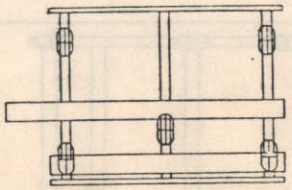
PAD AND SPRING LOCATIONS

STANDARD RACK



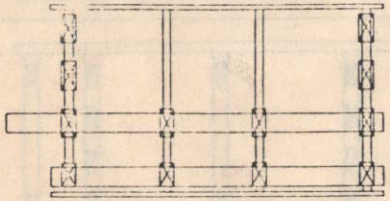
2 AND 3 COMPRESSORS

10 PADS REQUIRED



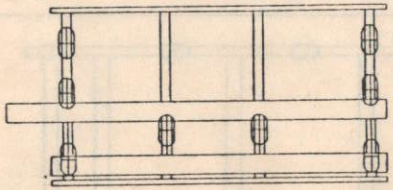
2 AND 3 COMPRESSORS

5 SPRINGS REQUIRED



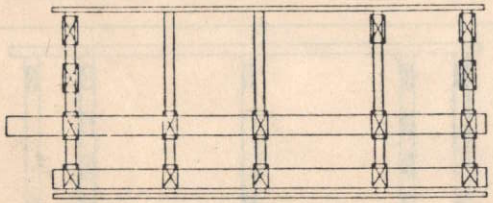
3 AND 4 COMPRESSORS

12 PADS REQUIRED



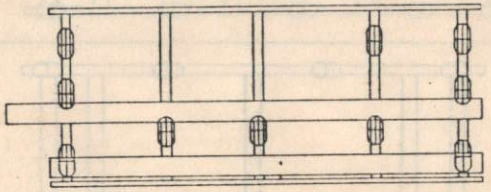
3 AND 4 COMPRESSORS

8 SPRINGS REQUIRED



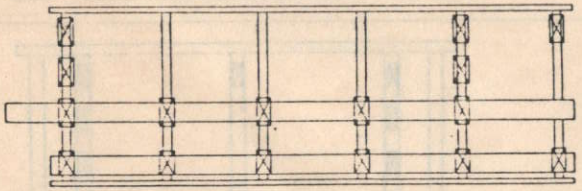
4 AND 5 COMPRESSORS

15 PADS REQUIRED



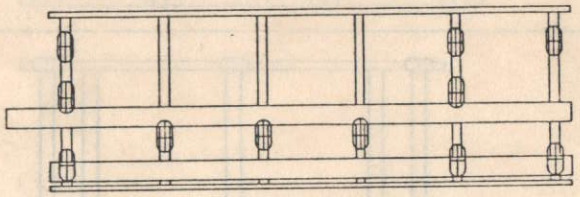
4 AND 5 COMPRESSORS

10 SPRINGS REQUIRED



5 AND 6 COMPRESSORS

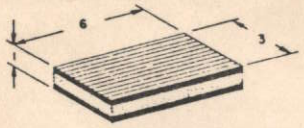
16 PADS REQUIRED

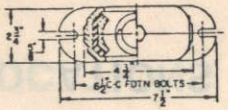


5 AND 6 COMPRESSORS

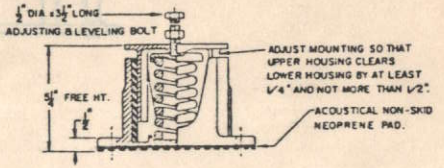
11 SPRINGS REQUIRED

VIBRATION PAD



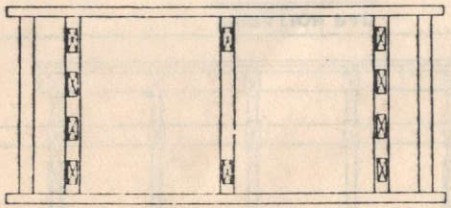


SPRING


½" DIA x 3½" LONG
ADJUSTING & LEVELING BOLT
ADJUST MOUNTING SO THAT UPPER HOUSING CLEARS LOWER HOUSING BY AT LEAST 1/4" AND NOT MORE THAN 1/2".
5¼" FREE HT.
½"
ACOUSTICAL NON-SKID NEOPRENE PAD.

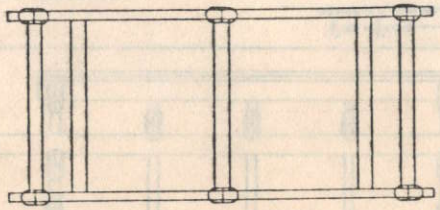
PAD AND SPRING LOCATIONS

NARROW RACK



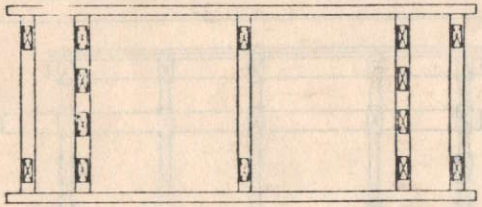
2 AND 3 COMPRESSORS

10 PADS REQUIRED



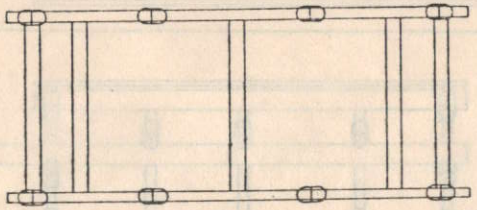
2 AND 3 COMPRESSORS

6 SPRINGS REQUIRED



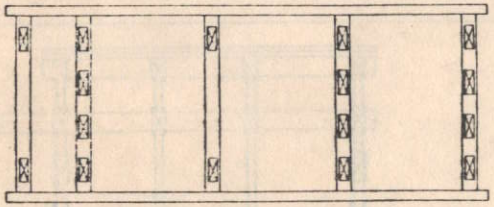
3 AND 4 COMPRESSORS

14 PADS REQUIRED



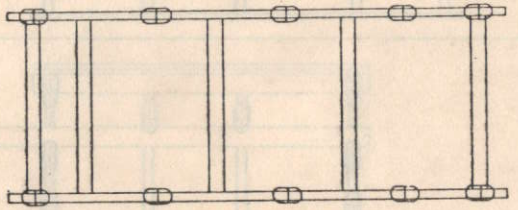
3 AND 4 COMPRESSORS

8 SPRINGS REQUIRED



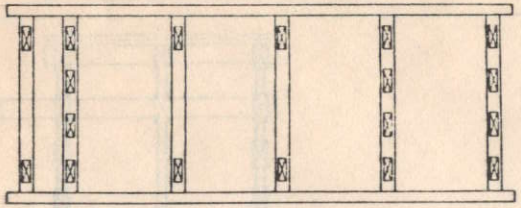
4 AND 5 COMPRESSORS

16 PADS REQUIRED



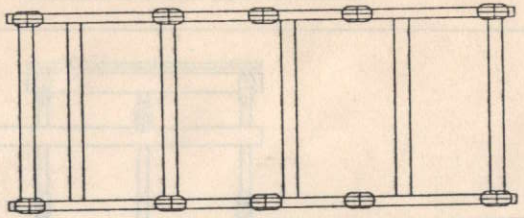
4 AND 5 COMPRESSORS

10 SPRINGS REQUIRED



5 AND 6 COMPRESSORS

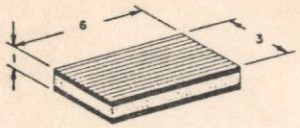
18 PADS REQUIRED

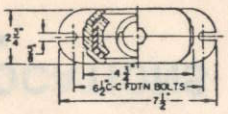


5 AND 6 COMPRESSORS

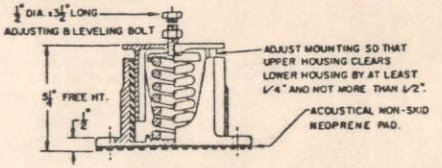
10 SPRINGS REQUIRED

VIBRATION PAD

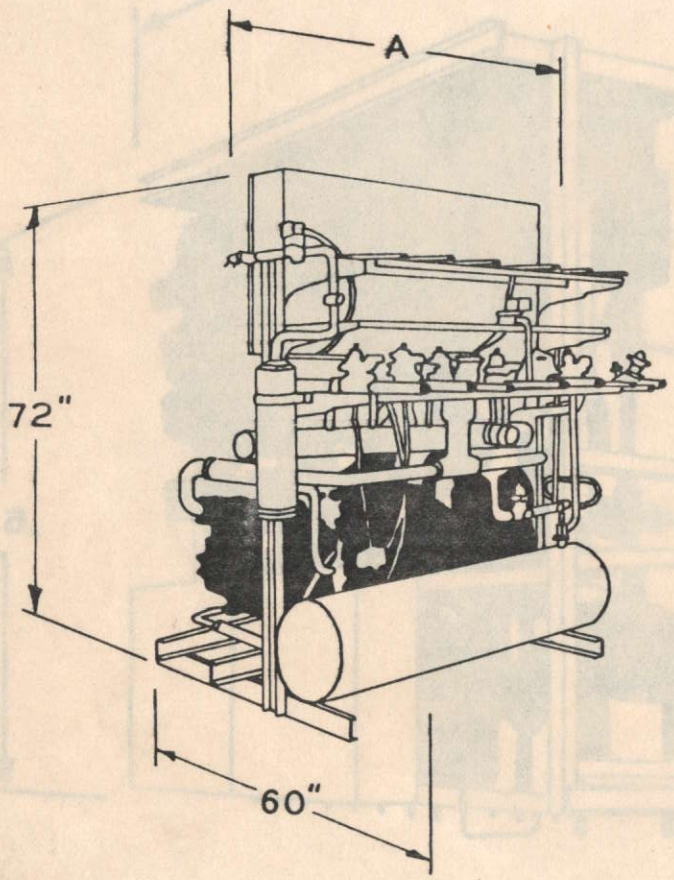




SPRING


⅝" DIA. x 3½" LONG
ADJUSTING & LEVELING BOLT
5¼" FREE HT.
½"
ADJUST MOUNTING SO THAT UPPER HOUSING CLEARS LOWER HOUSING BY AT LEAST 1/4" AND NOT MORE THAN 1/2".
ACOUSTICAL NON-SKID NEOPRENE PAD.

AF 8066



Unit Length Dim. "A"	Compressors & Length
76"	2 Compressors, 1-8 Circuits
	3 Compressors, 1-8 Circuits
104"	2 Compressors, 9-12 Circuits
	3 Compressors, 9-12 Circuits
	4 Compressors, 1-12 Circuits
126"	3 Compressors, 13-16 Circuits
	4 Compressors, 13-16 Circuits
	5 Compressors, 1-16 Circuits

(5)

LETTER	REVISED	DATE	BY

DATE 16 FEB 82

SCALE NONE

DRAWN JP

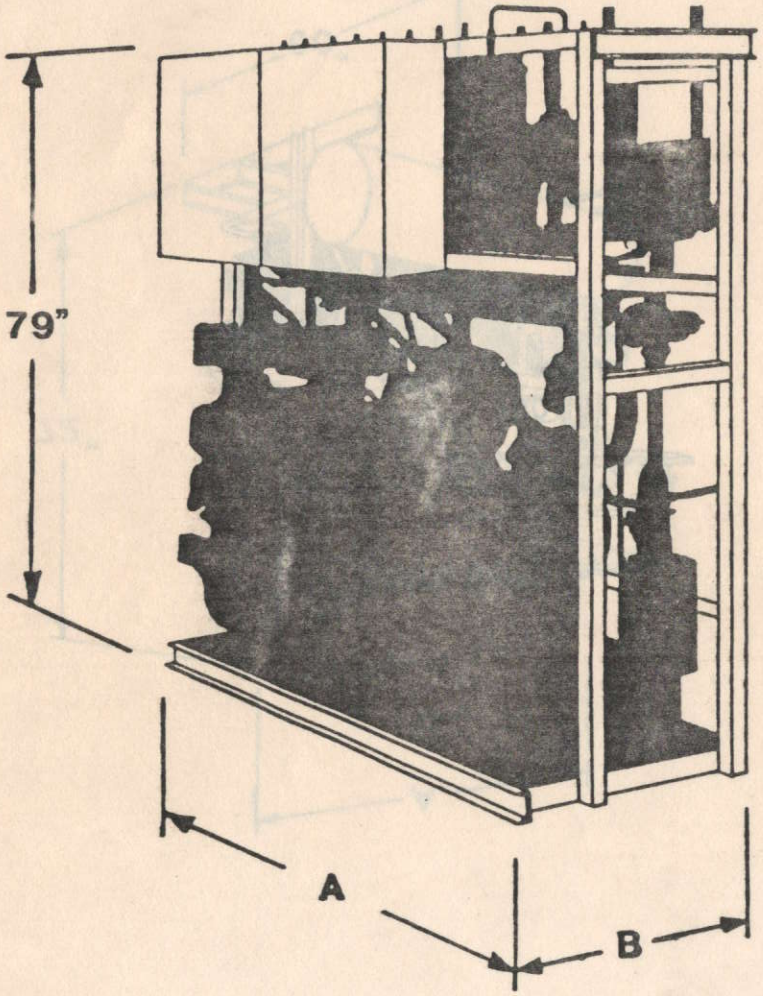
APPD

TITLE

PARALLEL UNIT DIMENSIONS

KYSOR | WARREN / SHERER
DIVISION OF KYSOR INDUSTRIAL CORPORATION

DRAWING NUMBER SA-82-121



Unit Length Dim. "A"	Compressors & Length
79"	2 Compressors, 1-8 Circuits
	3 Compressors, 1-8 Circuits
107"	2 Compressors, 9-12 Circuits
	3 Compressors, 9-12 Circuits
	4 Compressors, 1-12 Circuits
129"	3 Compressors, 13-16 Circuits
	4 Compressors, 13-16 Circuits
	5 Compressors, 1-16 Circuits

Unit Width Dim. "B"	Compressors
36"	Copeland
36"	Carlyle-D
40"	Carlyle-E

LETTER	REVISED	DATE	BY

DATE 12/30/85

SCALE NONE

DRAWN

APPD

TITLE

PARALLEL UNIT DIMENSIONS - SLIMLINE

KYSOR | WARREN / SHERER
DIVISION OF KYSOR INDUSTRIAL CORPORATION

DRAWING NUMBER
PA-22287

UNIT DESIGNATION

Units are numbered, and circuits are designated including condenser and heat reclaim coils. All refrigeration circuits are numbered from one to the highest and from left to right facing the electrical panel.

Unit Model	No. Compressors	Compressor Manufacturer
EM 2	2	Copeland - Even
ED 2	2	Copeland (Discus)-Even
EC 2	2	Carlyle - Even
TM 3	3	Copeland - Uneven
TD 3	3	Copeland (Discus)-Uneven
TC 3	3	Carlyle - Uneven
EM 3	3	Copeland - Even
ED 3	3	Copeland (Discus)-Even
EC 3	3	Carlyle - Even
EM 4	4	Copeland - Even
ED 4	4	Copeland (Discus)-Even
EC 4	4	Carlyle - Even
TM 4	4	Copeland - Uneven
TD 4	4	Copeland (Discus)-Uneven
TC 4	4	Carlyle - Uneven

Application Temperature & Refrigerant Type

R-12	Medium Temp	FC
R-502	Medium Temp	RC
R-502	Low Temp	RL
R-22	High Temp	DH

Example Designation

TM3 - 2000 FC

R-12, Med. Temp
Total Nominal Horsepower (20)
3 Copeland Compressor - Uneven Sizes

CONSTRUCTION

The basic construction of the Parallel System is made up of carefully selected over-the-counter items that can be readily obtained at refrigeration wholesalers. As previously mentioned, each system is custom-designed to meet the needs of each customer. The following is a description of a Parallel System containing all of the components available.

ELECTRICAL

All solenoids, contactors, controls, time clocks, and crank case heaters are installed and wired at the factory. Electrical connections to the Parallel System include mainly three phase power and control circuits. These are made in the control panel. The control panel is located above the compressors and is serviced from the front of the system.

Parallel System units are available with compressors rated at 208/230/3/60 or 440/480/3/60 and a single power feed is required for the unit. If the compressors are 440/480/3/60 a separate 208/230/1/60 control circuit supply is required. If electric defrost is used a 208/230/3/60 supply is required, which may be combined with the control circuit supply. An optional transformer may be added to step down the 440V for the control circuit on each unit.

All field wiring must in compliance with the National Electrical Code and local codes. Minimum unit wiring ampacity and maximum fuse sizes as calculated per the National Electric Code are shown on the Parallel System nameplate.

Typical 208/230 and 440/480 volt wiring diagrams are shown with typical circuit wiring for different types of circuits on pages 28, 29, & 30. All types of defrost circuits may be intermixed in the panel depending on the individual store requirements. The wiring diagram sent with each Parallel System is the diagram for that particular unit and shows the circuit wiring as set up for that specific application.

Parallel System units with optional heat reclaim require two wires from the store environmental control panel supplying voltage requested by the customer.

PIPING

All circuit piping leaving the unit is equipped with shut-off valves. Shut-off valves for condenser and heat reclaim lines can be added at the customer's request. The system is sealed and leak tested before leaving the factory, and is shipped with a holding charge. See page 13 for general system piping arrangement.

COMPRESSORS

The compressors, Copeland or Carlyle are solid mounted to the base frame assembly. All systems will incorporate the AC & R oil floats and pressurized reservoir. Crankcase heaters, if provided, will be installed and wired. Cylinder head cooling fans will be installed on all low temperature systems. These fans are optional on medium temperature units. High/Low pressure controls and oil failure controls are installed and wired on each compressor. The suction filter cores are factory installed while the liquid drier cores are supplied for field installation.

HOT GAS DEFROST

Due to the compactness of the Parallel System and the availability of hot gas at the unit, hot gas defrost can be readily incorporated into the total custom design. The hot gas header is installed between the liquid and suction headers at the rear of the unit and each circuit is piped into the suction line. Manual shut-off and solenoid valves are installed and wired. The hot gas line is piped into the suction line up stream of the EPR or solenoid valve. All controls, valves, and piping are factory installed. Cases are equipped accordingly when ordered.

When defrost is initiated by the time clock the master liquid line solenoid* is energized. Circuit liquid line solenoid (if used) and suction stop are de-energized. The hot gas enters the suction line and travels to the evaporator (Reverse Cycle). As the hot gas condenses in the evaporator, it travels around the expansion valve through a check valve and back through the liquid line header. This returning liquid in turn feeds the circuits still calling for refrigeration. Should the returning liquid not be adequate for the demand, the pressure in the liquid header will start to drop. When a difference of twenty (20) pounds between the liquid header and main liquid line pressures occurs, a twenty (20) pound differential check valve piped in parallel with the main liquid line solenoid will open and supply the required liquid.

A typical piping schematic for gas defrost can be found on page 14.

*Master liquid line solenoid is NORMALLY OPEN - Close when energized.

HEAT RECLAMATION AND HEAD PRESSURE CONTROL

The basic concept of refrigeration is to transfer heat from one place to another. Heat is removed from the case and its contents and transferred to the outside or ambient air. By incorporating a multi-circuited coil in to the air handling system of the store, this heat can be diverted to heat the store.

HEAT RECLAIM

The diverting valve is factory installed. Piping and wiring from the controls and the heat reclaim coil are field installed. Warren/Sherer requirements for piping are shown on Page 15 and are at the customer's choosing. The check valve required for series piping is normally field furnished, but can be supplied as an option. Standard valve coil voltage is 208. Other voltages can be furnished on request.

The heat reclamation coil is installed in the store duct system and is integrated with the heating and air-conditioning system. The coil must be downstream of the AC coil and upstream of any booster heaters. The air should enter the refrigerant outlet side of the coil, and the liquid outlet of the coil should be lower than the gas inlet.

Simply speaking, a diverting valve is installed in the discharge line of the compressor and is piped to the normal condenser and the heat reclaim coil. This valve is equipped with an electric solenoid that is activated by the environmental control panel.

HEAD PRESSURE CONTROL

There is an additional constant pressure valve installed on the discharge line from the compressor, Item 12 on Page 13. It should be noted that this valve is after the supply to the hot gas header and maintains a constant pressure to the hot gas header. The hot gas needed for defrosting is more critical than the reclaim, should it call for both at the same time. Warren/Sherer incorporates the series system of piping in heat reclaim, the gas passed from the heat reclaim coil to the condenser and back to the receiver. Should the receiver pressure drop below the setting of the hot gas bypass valve, the valve will open to keep pressure on the liquid receiver.

CONDENSERS

All condensers should be located at an elevation higher than the Parallel System to assure liquid drainage from the condensers to the receiver. If the condenser has dual drop legs to a single unit, an elevation difference of at least 6ft. is required. The dual drop legs should be dropped the 6ft. before being joined together. This is to prevent the possibility of some of the condenser tubes being logged with liquid.

The remote air-cooled condensers must be located so as to receive free air flow through the coil. Exhaust heat from any source must not be allowed to interfere with condenser operations. Vertical air flow condensers must be cross-leveled. See page 45.4, Table 9 in Condenser Bulletin for recommended settings.

THE OIL SYSTEM

AC & R Oil Control System

The AC & R oil control system provides a method of regulating the oil level in each individual crankcase. It does not require that the compressors be the same make or model. The AC & R oil control system uses three basic components:

1. Oil Level Regulators 2. Oil Reservoir 3. Oil Separator

Each compressor has an oil level regulator attached to control the oil level in each individual compressor. The regulators are supplied oil by the common oil reservoir, which in turn is supplied by the oil separator.

The oil level regulator controls the oil level in each individual crankcase with a float operated valve. It holds back excess oil until the oil level in the compressor crankcase drops, lowering the float and opening the valve. Oil from the oil reservoir will then be admitted into the crankcase, raising the float. When the correct level is reached, the valve will close stopping the flow of oil to that particular crankcase.

The oil level observed in the sight glass should be within 1/8" of the center of the sight glass on S-9110 series regulators and within the lower quarter of the sight glass on S-9120 series regulators. Maximum differential working pressure is 50 PSIG on the float mechanism. The regulator is U.L. approved at 450 PSIG working pressure design with 2250 PSIG burst strength.

A reserve of oil is necessary for the operation of the AC & R oil control system. The oil reservoir is the holding vessel for this stand by oil. It has two sight ports on the shell to observe the oil level inside the vessel. Oil is fed into the oil reservoir by the oil separator. Pressure in the reservoir is maintained at 5 PSIG above suction pressure by a differential check valve on top of the reservoir.

The valve on the top of the oil reservoir automatically receives oil from the oil separator (open position). To add oil to the oil reservoir manually, close the valve and fill the oil reservoir through the 1/4" flare connection on the side of the valve. Open valve after filling.

The valve on the bottom of the oil reservoir is the distribution valve to the oil level regulators (open position). To remove oil from the oil reservoir, close the valve and use the 1/4" flare connection on the side of the valve to drain the oil out. Open valve after draining.

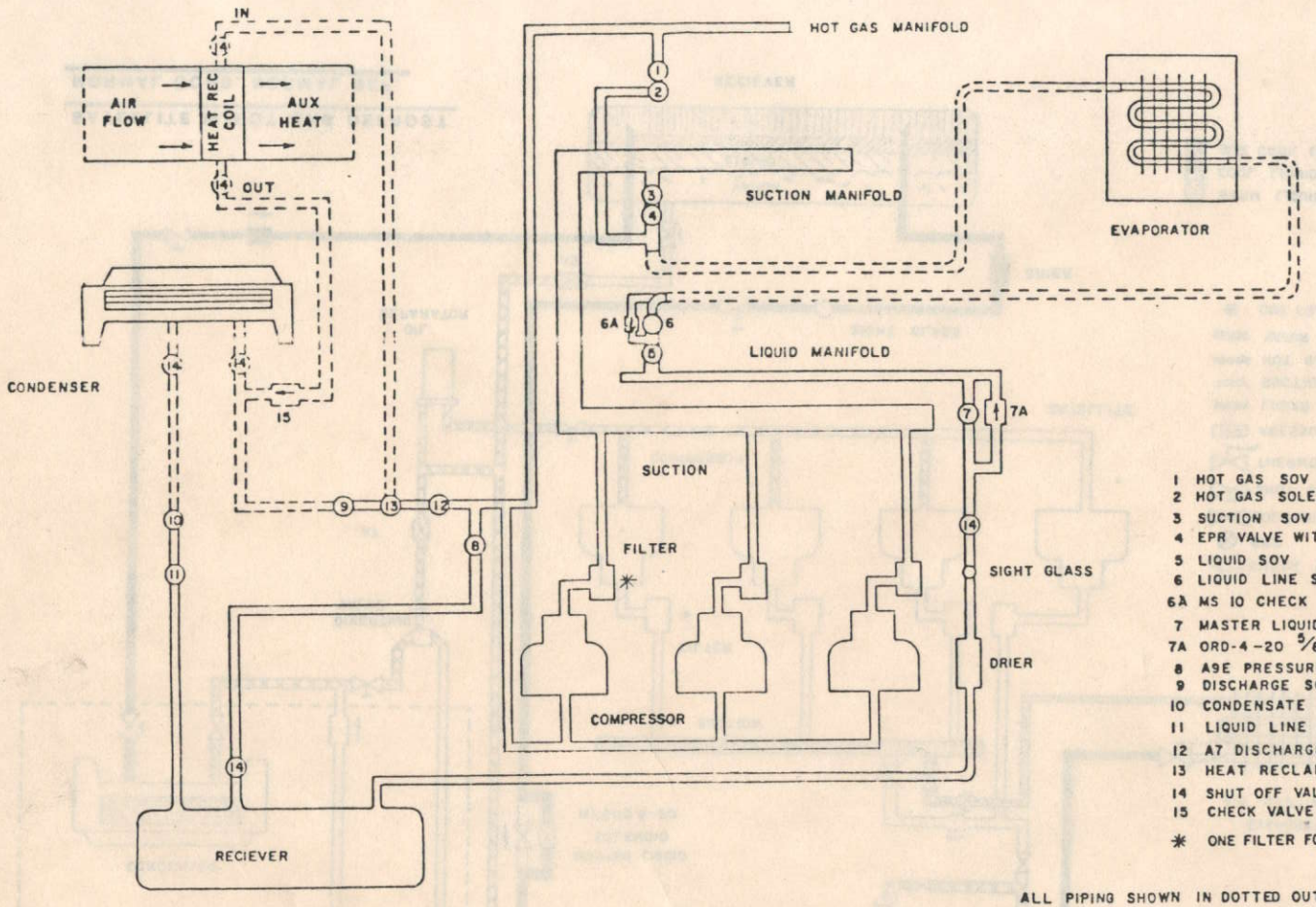
On system start-up of a new parallel system, oil should be added to the reservoir until oil is visible in the upper sight glass port, NOT ABOVE IT. It is commonly accepted that in a new refrigeration system, some oil will be absorbed by the refrigerant as the system operates. After two hours of operation, the oil reservoir should again be filled to the upper sight glass and again after two days. The oil level in the reservoir must be observed on each service call. Oil should not be added again until the oil level falls below the lower sight glass port.

SATELLITE COMPRESSOR

A compressor may be added to the Parallel System for ice cream or fresh meat cases. This compressor would maintain lower suction pressure than the main suction header and provide several advantages over a remote unit.

Hot gas defrost would be available to the ice cream circuits if desired, and the suction would be connected to the main header providing assistance on pull-down and standby protection should the satellite compressor fail.

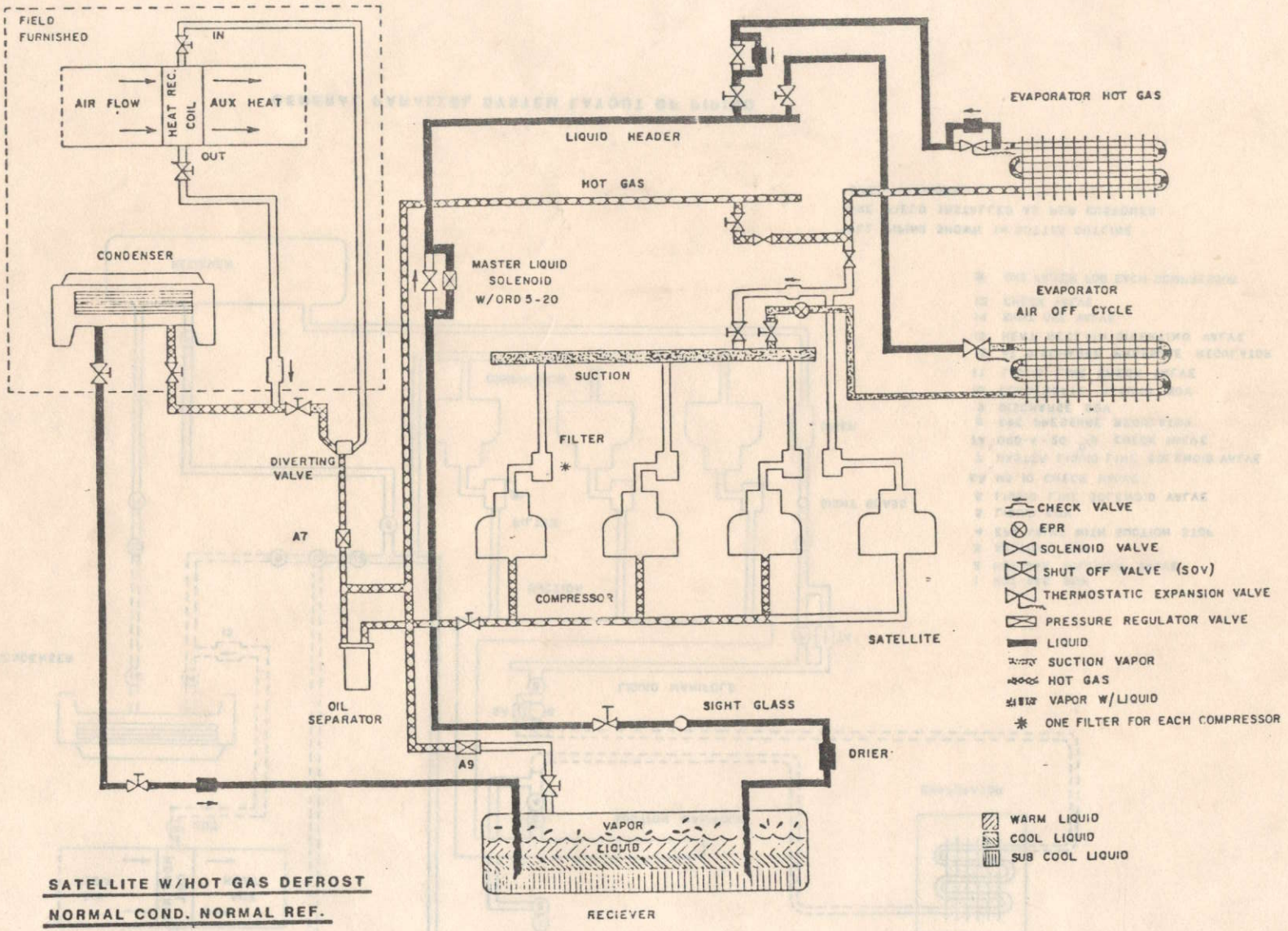
See page 14 and 16 for satellite piping schematic.



1 HOT GAS SOV
2 HOT GAS SOLENOID VALVE
3 SUCTION SOV
4 EPR VALVE WITH SUCTION STOP
5 LIQUID SOV
6 LIQUID LINE SOLENOID VALVE
6A MS 10 CHECK VALVE
7 MASTER LIQUID LINE SOLENOID VALVE
7A ORD-4-20 5/8 CHECK VALVE
8 A9E PRESSURE REGULATOR
9 DISCHARGE SOV
10 CONDENSATE RETURN SOV
11 LIQUID LINE CHECK VALVE
12 A7 DISCHARGE PRESSURE REGULATOR
13 HEAT RECLAIM DIVERTING VALVE
14 SHUT OFF VALVE
15 CHECK VALVE
* ONE FILTER FOR EACH COMPRESSOR

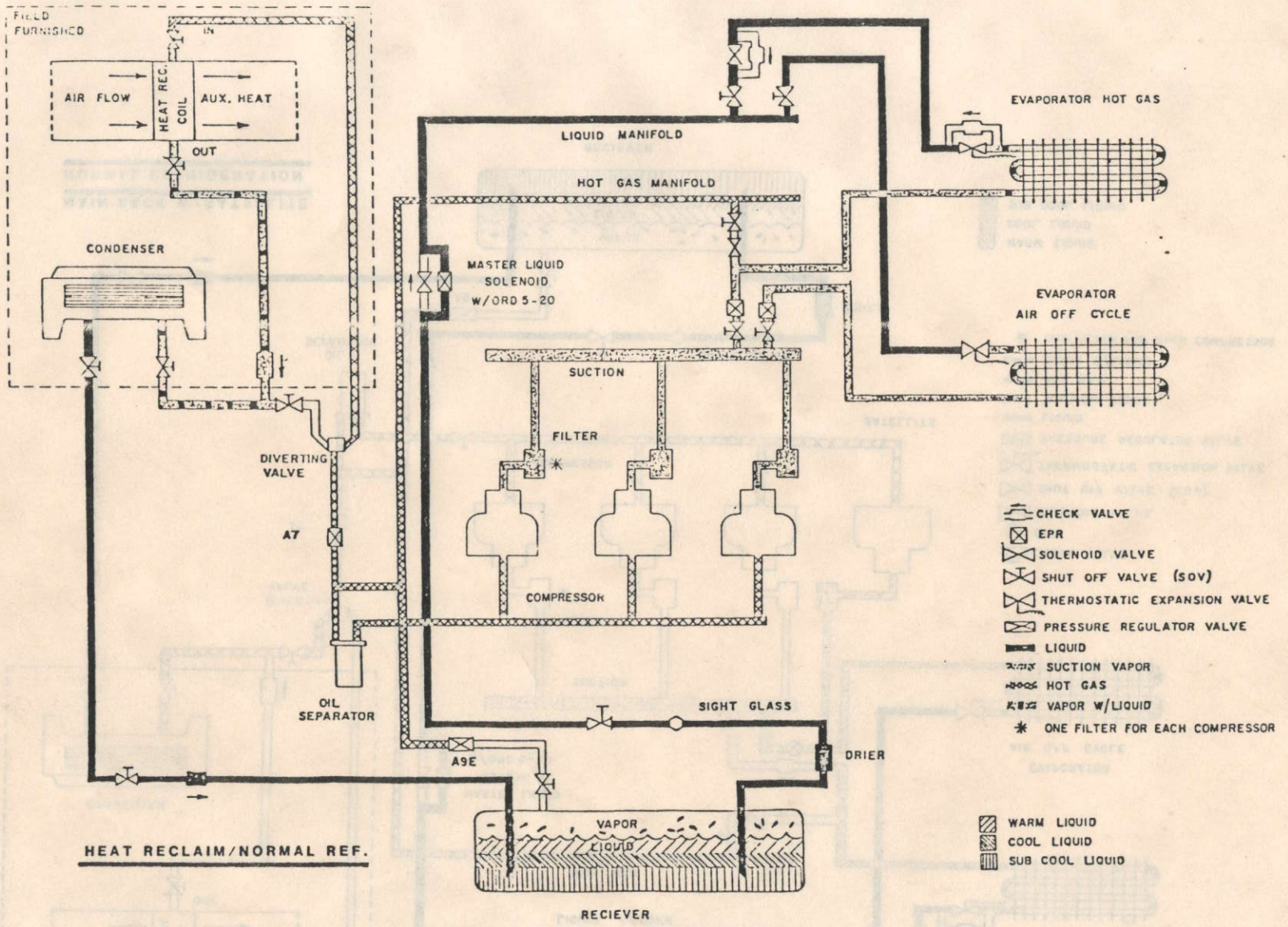
ALL PIPING SHOWN IN DOTTED OUTLINE ARE FIELD INSTALLED AS PER CUSTOMER SPECIFICATIONS.

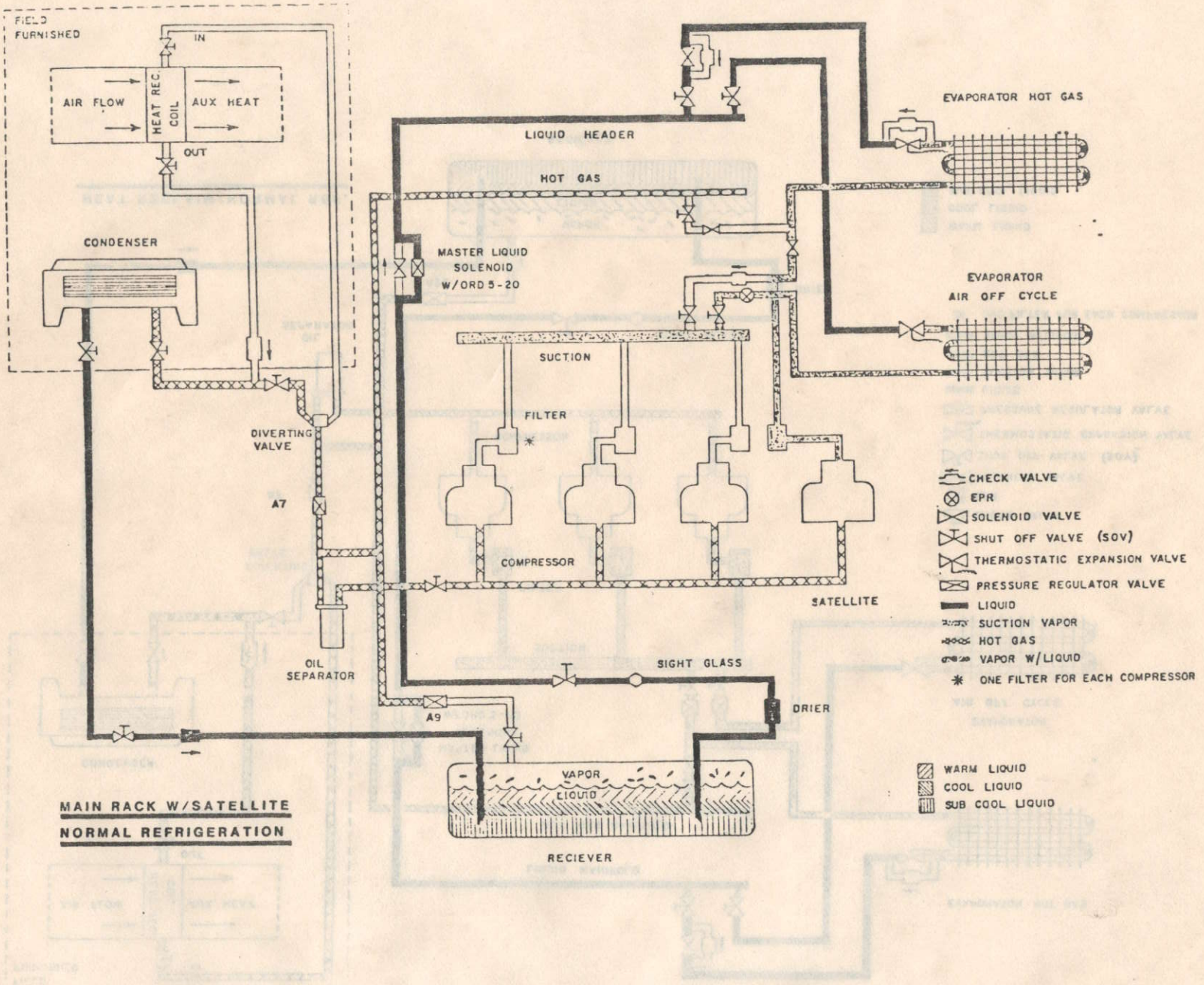
GENERAL PARALLEL SYSTEM LAYOUT OF PIPING



SATELLITE W/HOT GAS DEFROST

NORMAL COND. NORMAL REF.


FIELD FURNISHED
IN
AIR FLOW
HEAT REC. COIL
AUX. HEAT
OUT
CONDENSER
DIVERTING VALVE
A7
OIL SEPARATOR
A9E
LIQUID MANIFOLD
HOT GAS MANIFOLD
MASTER LIQUID SOLENOID W/ORD 5-20
SUCTION
FILTER
COMPRESSOR
EVAPORATOR HOT GAS
EVAPORATOR AIR OFF CYCLE
SIGHT GLASS
DRIER
VAPOR
LIQUID
RECIEVER
HEAT RECLAIM/NORMAL REF.
CHECK VALVE
EPR
SOLENOID VALVE
SHUT OFF VALVE (SOV)
THERMOSTATIC EXPANSION VALVE
PRESSURE REGULATOR VALVE
LIQUID
SUCTION VAPOR
HOT GAS
VAPOR W/LIQUID
ONE FILTER FOR EACH COMPRESSOR
WARM LIQUID
COOL LIQUID
SUB COOL LIQUID



MAIN RACK W/SATELLITE

NORMAL REFRIGERATION

PARALLEL SYSTEMS

Recommended Control Settings

A. Set (A7) Discharge Pressure Regulator at 170 PSIG with R-502; 100 PSIG with R-12. Gauge should be on compressor discharge service valve.

B. Set (A9) Receiver Pressure Regulator at 160 PSIG with R-502; 90 PSIG with R-12. Gauge should be on receiver outlet valve.

C. High Pressure Controls:

R-502	350	Cut-Out
R-12	250	Cut-Out

D. Low Pressure Controls:

Dual Metic - Without SSPC-2 Option, set low pressure control as shown

System	Compressor	Cut-Out	Cut-In
R-502 LT	Comp 1	1	9
	Comp 2	9	15
	Satellite (Ice Cream)	1	6
R-502 MT(+10dg F)	Comp 1	20	30
	Comp 2	29	38
R-502 MT(+20dg F)	Comp 1	30	41
	Comp 2	41	48
R-12 MT(+10dg F)	Comp 1	3	10
	Comp 2	8	13
R-12 MT(+20dg F)	Comp 1	8	15
	Comp 2	15	19

Tri Metic and Dual Metic with SSPC Option

If the SSPC control is being used to control temperatures in one or more systems, set the SSPC pressure control to average approximate EPR valve settings shown on Engineering Bulletin #85-130-3 for the particular systems involved. A pressure differential setting of 6 PSIG is recommended. If EPR valves are being used to control all systems, set the SSPC slightly lower than the lowest EPR valve setting. Again a 6 PSIG pressure differential setting is recommended. The compressor dual pressure controls should be set low enough that compressor control is always by the SSPC. Any satellite compressor will be controlled separately, by means of the dual pressure control.

E. Adjustable Time Delay Controls - Dual Metic Without SSPC Control

1. First compressor - Approximately 90 sec. (optional)
2. Second compressor - Approximately 180 sec.

F. Defrost and EPR Settings

See Engineering Bulletin #85-130-3

G. Adjustable Time Delay Controls - Satellite Compressors

Minimum Setting 3 minutes

WARREN/SHERER

Recommended Altech Control Settings

	Cut In	Cut Out
R-12 "FC" Units		
+10 Systems	15	11
+15 Systems	18	14
+20 Systems	21	17
R-22 "DH" Units		
+40 Systems	67	60
R-502 "RC" Units		
+10 Systems	42	38
+15 Systems	47	43
+20 Systems	52	47
R-502 "RL" Units		
-25 Systems	16	11

Note: These are approximate settings and could vary with actual operating conditions.

December 9, 1985

WARREN/SHERER

ALTECH OVERRIDE SETTINGS

Approximate settings for compressor dual pressure controls when Altech SSPC is placed in override positions.

Two Compressor System	Compressor	Cut-Out	Cut-In
R-502 LT	1	1	11
(-25Dg.F)	2	7	15
R-502 MT	1	20	33
(+10Dg.F)	2	29	40
R-502 MT	1	30	43
(+20Dg.F)	2	40	50
R-12 MT	1	2	11
(+10Dg.F)	2	7	14
R-12 MT	1	7	17
(+20Dg.F)	2	14	21

Three Compressor System			
R-502 LT	1	8	16
(-25Dg.)	2	4	12
R-502 MT	1	29	39
(+10Dg.F)	2	25	36
R-502 MT	1	41	50
(+20Dg.F)	2	35	45
	3	30	41
R-12 MT	1	7	14
(+10Dg.F)	2	5	12
R-12 MT	1	14	21
(+20Dg.)	2	10	18
	3	7	15

Four Compressor System

Use same settings as THREE COMPRESSOR SYSTEM.
Set compressor #4 same as Compressor #3.

Note: When compressor control is switched back to the Altech, reset the dual pressure controls to approximately 1psig.

December 9, 1985

SUBJECT: *INITIAL CONTROL SETTINGS

DATE: March 21, 1985

ENGINEERING BULLETIN: #85-130-3

SUPERSEDES: #80-130-12

WARREN//SHERER

NOTE: The attached recommended settings are based upon 75°F - 55% RH store conditions and properly loaded cases. Some adjustments may be required in case temperature of defrost frequency after initial opening dates, and store settles down to usual traffic and environment.

*General Control Recommendations:

(1) Thermostats are recommended as the primary control with Mastermetic units except on service meat cases (ZT & S3(J)) as noted in note 4.

(2) Low pressure controls may require different settings if cases are controlled by thermostats.

(3) EPR valves should only be used on Dualmetics and Trimetics on cases requiring higher temperature evaporators than system design level. EPR valves are not recommended for ice cream applications.

(4) Service meat cases (ZT & S3(J)) should always have EPR as primary control and temperature thermostat as secondary control for peak performance.

(5) All reach-in's must have positive temperature control by thermostat or EPR. Control settings indicated are for safety only and are not intended for temperature control.

DEFROST CONTROL SETTINGS

APPLICATION	CASE MODEL	F/S-AD	F/S-E	F/S-OC	F/S-HG	DEF./24HR.
BEVERAGE	D4H			44		3
	DV5H			44		3
DAIRY	BQD/BRQD		30	40	20	4
	C1W (ALL)			40		4
	D5		30	40	20	4
	D6		30	40	20	4
	D6(R)L		30	40	20	6
	WALK-IN			60		3
DELI	D5				20	4
	D6		30	40	20	4
	M4A)G)	45		50	18	6
	S3J			60		2
	WALK-IN			60		3
FROZEN FOOD	BILA/EBILA	60	60		46	1
	ILA	60	60		46	1
	L4(A)	60	30		30	6
	L4H(A)	54	36		18	1
	L5(F)(A)	60	30		30	6
	LM1A(G)	54			46	4
	LV5H		70		34	2
	WALK-IN		34		18	2-4
	WIL		60		46	1
	WTLA/EWTLA	40	40		36	1
	XLA	60	60		46	1
ICE CREAM	BILA/EBILA		60		46	1-2
	I4H(A)		40		18	1-2
	I5F		34		18	6
	ILA		60		46	1-2
	IV5H		70		34	2
	WALK-IN		34		18	2-4
	WTLA/EWTLA		60		36	1-2
	XLA		60		46	1-2
MEAT	M1A(G)	45		50	18	3
	M4A(G)	45		50	18	6
	S3			80		1-2
	WALK-IN		34		18	2-4
	WIL		60		46	1
	ZT/ZTS			72		1
MEAT PREP	WALK-IN			60		1
PRODUCE	HZV ZV TZF			32		4
	P1W (ALL)			32		4
	WALK-IN			60		3

CONTROL SETTINGS R-12

APPLICATION	CASE MODEL	AIR TEMP	EPR	LP C/I *	LP C/O *
BEVERAGE	D4H	34 - 38	22#	20#	5#
	DV5H	34 - 38	22#	20#	5#
DAIRY	BQD/BRQD	24 - 28	15#	28#	15#
	C1W (ALL)	28 - 32	19#	28#	15#
	D5	28 - 32	17#	25#	12#
	D6	28 - 32	19#	28#	15#
	D6(R)L	28 - 32	15#	28#	12#
	WALK-IN	35 - 39	22#	28#	20#
DELI	D5	24 - 28	14#	22#	10#
	D6	24 - 28	15#	28#	12#
	M4A)G)	25 - 29	15#	27#	13#
	S3J	28 - 32	22#	20#	5#
	WALK-IN	33 - 38	21#	28#	18#
FROZEN FOOD	BILA/EBILA	-10 - 0	N/A	N/A	N/A
	ILA	-10 - 0	N/A	N/A	N/A
	L4(A)	(0) - - 5	N/A	N/A	N/A
	L4H(A)	(0) - - 5	N/A	N/A	N/A
	L5(F)(A)	(0) - - 5	N/A	N/A	N/A
	LM1A(G)	-10 - 0	N/A	N/A	N/A
	LV5H	(0) - - 5	N/A	N/A	N/A
	WALK-IN	- 5 - -10	N/A	N/A	N/A
	WIL	-10 - 0	N/A	N/A	N/A
	WTLA/EWTLA	-10 - 0	N/A	N/A	N/A
	XLA	-10 - 0	N/A	N/A	N/A
ICE CREAM	BILA/EBILA	-24 - -28	N/A	N/A	N/A
	I4H(A)	-10 - -15	N/A	N/A	N/A
	I5F	-22 - -12	N/A	N/A	N/A
	ILA	-24 - -28	N/A	N/A	N/A
	IV5H	-12 - -18	N/A	N/A	N/A
	WALK-IN	-10 - -15	N/A	N/A	N/A
	WTLA/EWTLA	-24 - -28	N/A	N/A	N/A
	XLA	-24 - -28	N/A	N/A	N/A
MEAT	M1A(G)	20 - 24	12#	27#	11#
	M4A(G)	20 - 24	12#	27#	11#
	S3	34 - 38	22#	20#	5#
	WALK-IN	28 - 32	20#	28#	20#
	WIL	20 - 24	12#	27#	11#
	ZT/ZTS	34 - 38	18#	28#	15#
MEAT PREP	WALK-IN	45 - 50	28#	35#	25#
PRODUCE	HZV ZV TZP	38 - 42	20#	35#	20#
	P1W (ALL)	38 - 42	20#	35#	20#
	WALK-IN	35 - 39	24#	28#	20#

Engineering Bulletin #85-130-3

CONTROL SETTINGS R-502

APPLICATION	CASE MODEL	AIR TEMP	EPR	LP C/I *	LP C/O *
BEVERAGE	D4H	34 - 38	55#	30#	10#
	DV5H	34 - 38	55#	30#	10#
DAIRY	BQD/BROD	24 - 28	43#	60#	46#
	C1W (ALL)	28 - 32	50#	60#	46#
	D5	28 - 32	45#	58#	37#
	D6	28 - 32	50#	60#	46#
	D6(R)L	28 - 32	43#	60#	40#
	WALK-IN	35 - 39	54#	65#	51#
DELI	D5	24 - 28	42#	54#	33#
	D6	24 - 28	43#	60#	40#
	M4A)G)	25 - 29	42#	63#	42#
	S3J	28 - 32	54#	50#	24#
	WALK-IN	33 - 38	52#	63#	49#
FROZEN FOOD	BILA/EBILA	-10 - 0	12#	16#	9#
	ILA	-10 - 0	12#	16#	9#
	L4(A)	(0) - - 5	14#	10#	4#
	L4H(A)	(0) - - 5	17#	15#	5#
	L5(F)(A)	(0) - - 5	14#	10#	4#
	LM1A(G)	-10 - 0	12#	16#	9#
	LV5H	(0) - - 5	17#	15#	5#
	WALK-IN	- 5 - -10	15#	16#	9#
	WIL	-10 - 0	12#	16#	9#
	WTLA/EWTLA	-10 - 0	12#	16#	9#
	XLA	-10 - 0	12#	16#	9#
ICE CREAM	BILA/EBILA	-24 - -28	N/A	8#	2#
	I4H(A)	-10 - -15	N/A	8#	1#
	I5F	-22 - -12	N/A	12#	5#
	ILA	-24 - -28	N/A	8#	2#
	IV5H	-12 - -18	N/A	8#	1#
	WALK-IN	-10 - -15	12#	N/A	N/A
	WTLA/EWTLA	-24 - -28	N/A	8#	2#
	XLA	-24 - -28	N/A	8#	2#
MEAT	M1A(G)	20 - 24	38#	63#	37#
	M4A(G)	20 - 24	38#	63#	37#
	S3	34 - 38	54#	50#	24#
	WALK-IN	28 - 32	51#	65#	51#
	WIL	20 - 24	41#	63#	37#
	ZT/ZTS	34 - 38	48#	65#	42#
MEAT PREP	WALK-IN	45 - 50	65#	N/A	N/A
PRODUCE	HZV ZV TZP	38 - 42	50#	68#	52#
	P1W (ALL)	38 - 42	50#	68#	52#
	WALK-IN	35 - 39	54#	65#	51#

WARREN/SHERER CONDENSING UNIT CONTROL/ALARM PANEL

The Warren/Sherer condensing unit control/alarm panel provides a means of controlling multiple compressors on a condensing unit rack and also provides indication of mode of operation and transmission of alarm conditions.

Compressors are controlled by individual switches which indicate the presence of supply voltage to the compressors and compressor operation; additionally, individual refrigeration circuits are controlled by switches which also indicate the presence of supply voltage to the circuit and whether a circuit is in refrigeration or defrost.

Operating conditions of the compressors are controlled by an electronic pressure controller with separate cut-in and cut-out settings. The controller will bring compressors on and off line in accordance with refrigeration demand to maintain suction pressure in a range determined by the settings on the pressure controller.

An electronic alarm panel within the unit continuously monitors critical conditions of the system; these are oil failure, high discharge pressure, high suction pressure, phase loss, and refrigerant level. (Internal time delays of 15 minutes for high suction and 60 minutes for liquid level prevent nuisance alarms.) Oil failure is signalled by the presence of 208VAC signal from an oil switch contained in each compressor.

Similarly the presence of a contact closure from a pressure switch in the discharge and suction headers signals high discharge and/or high suction pressure alarm conditions. Phase loss indication is signalled by contact closure from a relay wired to a three phase power supply phase monitor.

Refrigerant liquid level is sensed by a sensor mounted in the receiver. An L.E.D. bar graph on the panel indicates percent liquid level within the receiver. The low refrigerant level alarm is energized at 15% liquid level and heat reclaim is locked out at 10%. Once locked out the liquid level must reach 20% before heat reclaim and can again be energized.

The presence of any alarm condition will control the alarm relay which provides transmission of an alarm signal. A man/auto/off switch on the panel will automatically reset the alarm relay when all alarm conditions cease when in the auto mode. In the manual mode the alarm reset switch must be depressed to remove the transmission of an alarm condition from the alarm relay whenever it has been triggered by an alarm condition. In the off mode no alarm signal will be transmitted in the event of an alarm condition; however, the L.E.D. circuitry for each alarm condition will remain active.

Specifications

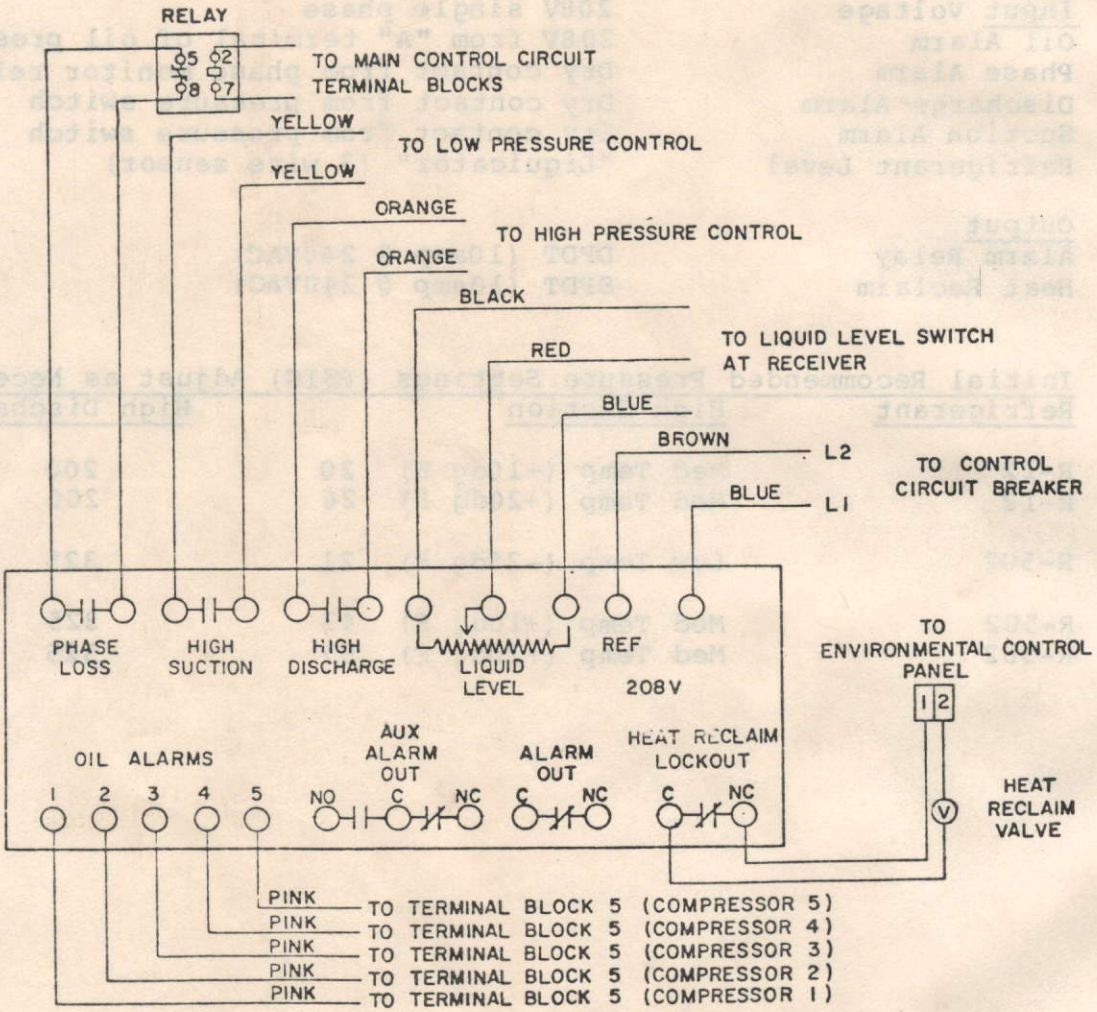
Input Voltage	208V single phase
Oil Alarm	208V from "A" terminal of oil pressure switch
Phase Alarm	Dry contact from phase monitor relay
Discharge Alarm	Dry contact from pressure switch
Suction Alarm	Dry contact from pressure switch
Refrigerant Level	"Liquicator" (3 wire sensor)

Output	
Alarm Relay	DPDT (10amp @ 240VAC)
Heat Reclaim	SPDT (10amp @ 240VAC)

Initial Recommended Pressure Settings (PSIG) Adjust as Necessary

Refrigerant	High Suction		High Discharge
R-12	Med Temp (+10dg F)	20	200
R-12	Med Temp (+20dg F)	26	200
R-502	Low Temp (-25dg F)	21	325
R-502	Med Temp (+10dg F)	47	325
R-502	Med Temp (+20dg F)	57	325

WARREN / SHERER ALARM HOOKUP



CONNECT WARREN/SHERER REMOTE ANNUNCIATOR TO ALARM-OUT TERMINALS ON UNIT. IF MORE THAN ONE UNIT, WIRE TERMINALS IN PARALLEL. AUXILIARY ALARM-OUT TERMINALS MAY BE USED FOR TELEPHONE DIALER OR SECOND REMOTE ANNUNCIATOR AS REQUIRED.

REV. 5-6-85

INSTRUCTIONS FOR MOTORSAVER

AFTER APPLYING POWER TO THE MOTORSAVER, THE OUTPUT RELAY SHOULD CLOSE AND THE "RUN LIGHT" SHOULD COME ON. IF THE OUTPUT RELAY DOES NOT CLOSE, PERFORM THE FOLLOWING TESTS:

A. CHECK THE VOLTAGES BETWEEN L1-L2, L1-L3, & L2-L4. THESE VOLTAGES SHOULD BE APPROXIMATELY EQUAL AND WITHIN 10% OF THE RATED 3 PH. LINE TO LINE VOLTAGE.

B. IF THESE VOLTAGES ARE EXTREMELY LOW OR WIDELY UNBALANCED, CHECK THE POWER SYSTEM TO DETERMINE THE CAUSE OF THE PROBLEM.

C. IF THE VOLTAGES ARE GOOD, TURN OFF THE POWER AND INTERCHANGE ANY TWO OF THE THREE LEADS L1, L2, L3. THIS MAY BE NECESSARY AS MOTORSAVER IS SENSITIVE TO PHASE REVERSAL.

Rev. 2/13/85

WARREN/SHERER

CASE WIRING IDENTIFICATION 115/VOLT 1 PHASE

WIRE NO:	
#1:	Anti-Sweat Heater
#2:	Anti-Sweat Heater
#3:	Drain Heater & Fan Motor
#4:	Drain Heater & Fan Motor
#5:	Light Circuit
#6:	Light Circuit
#11:	Air Def. Blower (LM1AG only) 115 V
#12:	Air Def. Blower (LM1AG only) 115 V
#15:	Dual Temperature (LM1AG only)
#16:	Dual Temperature (LM1AG only)

Note: All above to be wired to proper voltage that remains on at all times.

WARREN/SHERER

CASE WIRING CONNECTION TO UNITS

WIRE NO:		(WARREN/SHERER) DM/TM	MAH/SAH
#7:	Def. Heaters (Elec Def)	*	*
#8:	Def. Heaters (Elec Def)	*	*
#7:	Def. Relay Coil (Air Def)	L	N
#8:	Def. Relay Coil (Air Def)	2	3
#9:	Temperature Control	T	4
#10:	Temperature Control	L	**
#17:	Def. Termination	L	N
#18:	Def. Termination	8	X
#19:	Def. Relay Cir. (I4H/IV5H)	1	4

* Defrost Contactor
** Wires in series w/press. control

Note:
1) Dual & Tri-metic: Connections at unit electrical panel.
2) SAH & MAH: Connections at 8145-20 time clock at unit.

WARREN/SHERER

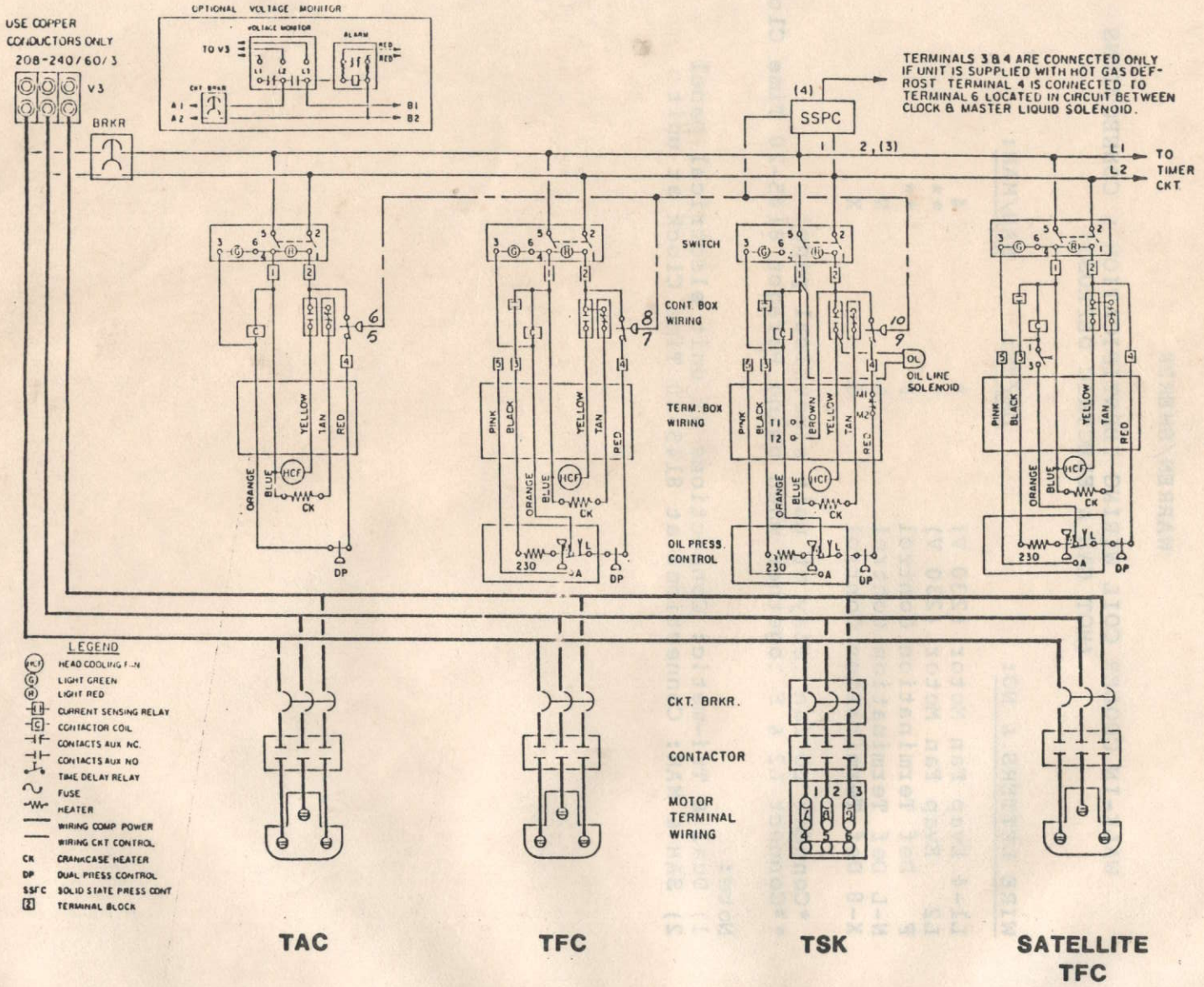
WALK-IN COOLER COIL WIRING IDENTIFICATION & CONNECTIONS (HOT GAS & ELECTRIC DEFROST)

WIRE LETTERS & NO:	DM/TM:	SAH/MAH:
L1-4 Evap Fan Motor (230 V)	*	4
L2 Evap Fan Motor (230 V)	*	**
F Def Termination Control	F	**
N-L Def Termination Control	L	N
X-8 Def Termination Control	8	X

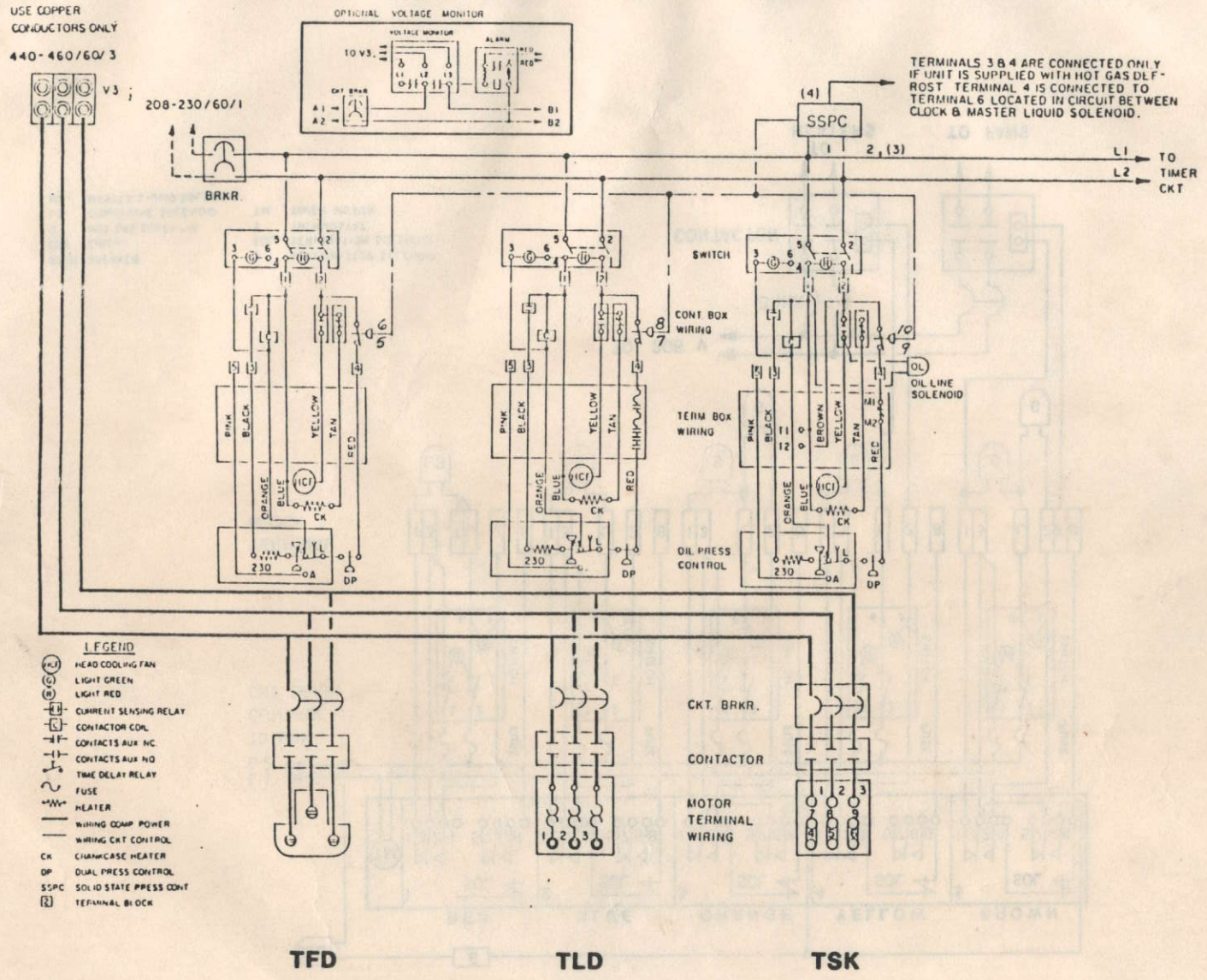
*Connect to fan relay at unit electrical panel
**Connect L2 & F together when using Paragon 8145-20 Time Clock

Note:
1) Dual & Tri-metic: Connections at unit electrical panel
2) SAH & MAH: Connections at 8145-20 Time Clock at unit

TYPICAL COMPRESSOR WIRING FOR THREE COMPRESSOR W/SATELLITE AND SHIFT LOGIC WIRED 208/60/3

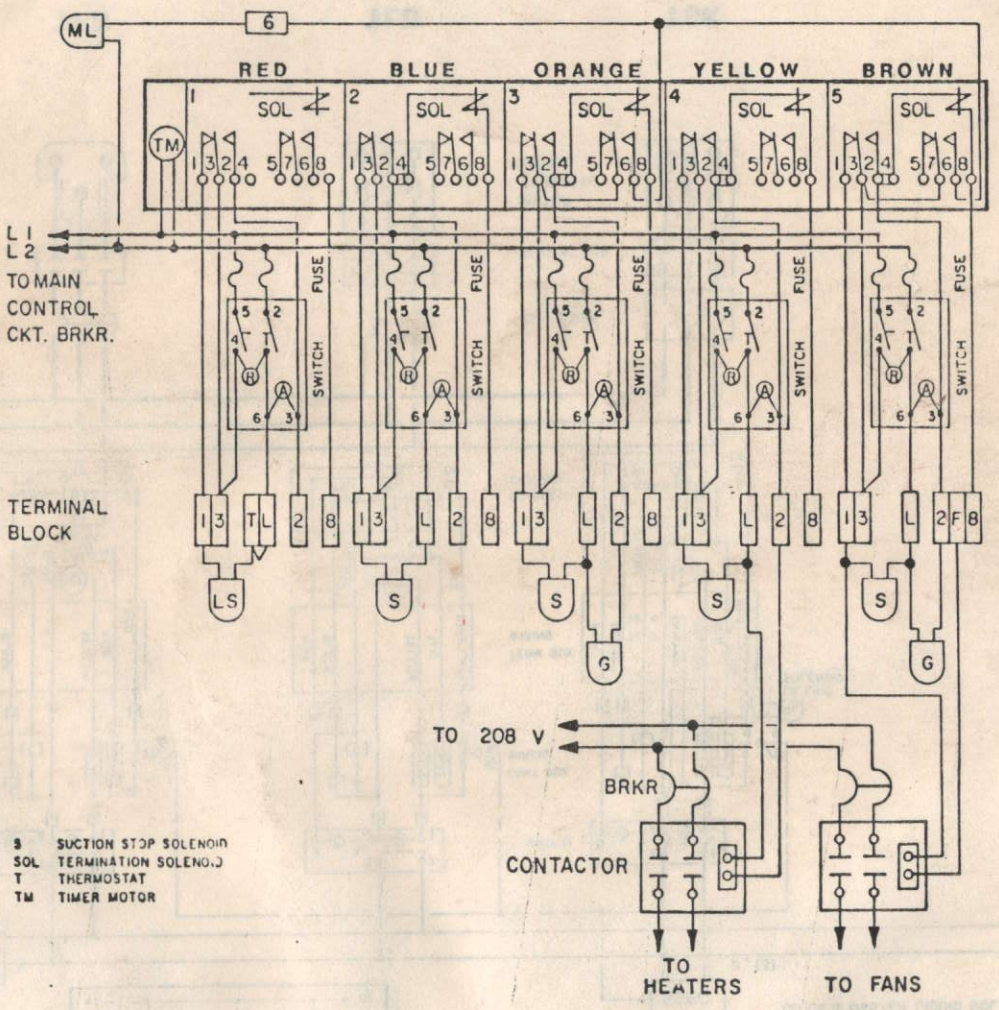


TYPICAL COMPRESSOR WIRING FOR THREE COMPRESSOR AND SHIFT LOGIC WIRED 460/60/3



TFD **TLD** **TSK**

TYPICAL TIMING CIRCUIT WIRING



BRKR	BREAKER	S	SUCTION STOP SOLENOID
CKT	CIRCUIT	SOL	TERMINATION SOLENOID
G	HOT GAS SOLENOID	T	THERMOSTAT
LS	LIQUID LINE SOLENOID	TM	TIMER MOTOR
ML	MASTER LIQUID SOLENOID		

1. OFF-CYCLE **3. HOT GAS** **5. HOT GAS WALK-IN FREEZERS**

2. TEMPERATURE TERMINATE **4. ELECTRIC**

DUAL-METIC AND TRI-METIC LEAK CHECKING, EVACUATION, AND START-UP

1) To check the systems for leaks, leave all valves closed on suction and liquid manifolds. Add refrigerant to each circuit through the access port in the suction line at EPR valves or suction stop. Build up the pressure to a maximum of 150 lbs. using dry nitrogen and the appropriate refrigerant. Each circuit can be leak checked in this way, one at a time.

2) After each circuit has been checked, open all valves to allow the pressure into the unit assembly. Check to be sure pressure is throughout the assembly. Check all connections and accessories for leaks. (System is shipped with a holding charge).

3) After the system is leak checked, evacuate the system to 1500 microns for the first evacuation, install drier cores between first and second evacuation then evacuate system to 500 microns. After each evacuation, the system should be pressurized to 2# pressure with refrigerant before starting the next evacuation.

4) With the system in a vacuum, liquid charge the system by putting refrigerant into the liquid outlet of the receiver with the inlet valve closed and the liquid line shut-off closed. Add as much refrigerant to the receiver as possible (approximately 250 lbs.). Now you are ready to start the system.

5) Set all low pressure controls at approximately 2 PSIG cut-out and 12 PSIG cut-in. Recheck all hand valves and shut-off valves to be sure they are open. (Receiver inlet and liquid line valves were closed in step #4).

6) Add refrigeration oil to oil reservoir until oil is shown in upper glass.

7) Remove all time clock trippers or remove program from all defrost modules.

8) Check and be sure the condenser fan motors are running and will not cycle. All case fans and cooler fans must be running or operational if controlled by temperature.

9) With all compressor and control breakers and toggle switches off, apply power to the unit. If unit is using a MOTORSAVER the "red" running light must come on before going any further. Check with a volt meter to see if correct voltage is connected to unit.

10) Now, turn on the circuit breaker for the control circuit. If the unit is equipped with an Altech SSPC Controller, you can adjust the cut-in and cut-out at this time. Refer to pages 10 and 11 in the SSPC Manual for these adjustments based on the lowest evaporator temperature.

11) Check the actual suction header pressure with an accurate gauge and see if the Altech is displaying the same pressure. (Pressure must be below 65 PSIG before this can be done). Calibrate as necessary. Refer to pages 13, 14, and 15 in SSPC Manual. Set Altech Controller on override.

12) Turn on circuit breakers to all compressors. All rocker switches on center control panel must be off.

13) Close control panel doors before actually starting compressors.

14) Now, with a low side gauge and high side gauge installed, turn on the rocker switch to the smallest compressor. Allow the compressor to pull the suction down to your approximate operating pressure of the system. As the pressure lowers, turn on one circuit rocker switch at a time. Try to maintain no more than 20 PSIG above Altech cut-in pressure. Once the suction pressure stays high, turn on the rocker switch for compressor #2. Continue turning on circuits and compressors as necessary.

15) You may find it necessary to open the manual stems on the EPR valves during the start-up to lower case temperatures and keep compressors running.

16) Now that the system is operating, it is time to set the A7 and A9 valves. See page 16 for settings. Once they are set, recheck again as these settings are important.

17) Set and check expansion valve superheat on each cabinet. (EPR stems (manual) must be open).

18) Set each EPR valve (manual stems closed) as needed (approximately 2 lbs. less than desired evaporator temperature). Suction header pressure must be lower than setting on EPR before valve can be set correctly.

19) Check each fixture temperature and adjust EPR valves as necessary to maintain proper temperature.

20) Readjust Altech as needed to maintain necessary suction header pressure.

21) Set condenser fan controls as recommended to maintain head pressure and liquid receiver level. Recommended settings for Warren/Sherer condensers are the Condenser Technical Bulletin.

22) Check refrigerant level in receiver and add as necessary. Minimum level is 20% in the coldest weather for area.

23) Add defrost pins or tripper to time clock and set defrost failsafe. Check defrost timer and temperature at which cases terminate.

24) Set the time delay on satellite compressor(s) at 3 minutes. This delay allows the satellite compressor to wait after defrost of the circuit for the Dual-Metic or Tri-Metic to lower the circuit pressure so not to overload the satellite.

25) If The unit is equipped with an Alarm Status panel, check to see that the operating switch is either in Manual or Auto depending on desired operation. See Alarm Status instructions for operation detail.

26) Check oil reservoir after two (2) days operation and add oil as necessary to maintain a level between the two sight glasses. Do not add more than a total of 2 or 3 gallons of oil to each system. If more than this is needed, recheck piping and etc., as oil is not returning to unit as designed.

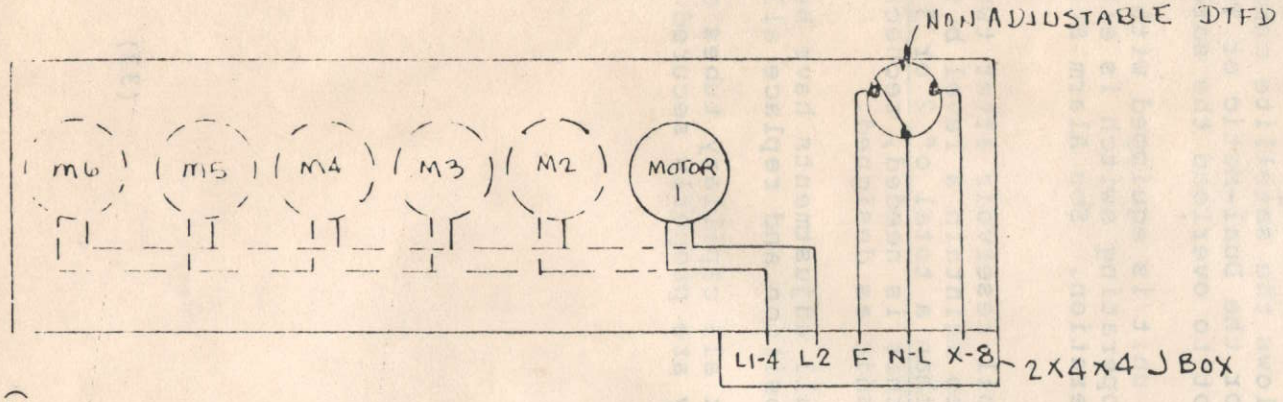
27) After all adjustments have been made, check all valves for proper stem position and replace all valve caps.

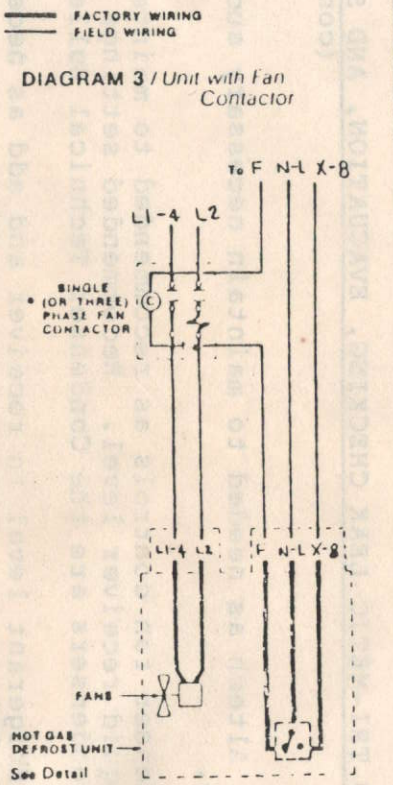
28) Recheck all capillary tubes on all pressure controls to be sure that they are properly secured and free of vibration.

8/10/85

107258

DESCRIPTION	EN NO.	BY DATE
INITIAL RELEASE	108-0844	BS 1-4-84





(34)

LEAVE LEADS 6" LONG - MIN. - IN J BOX
LABEL LEAD WIRES AS SHOWN
MOTORS MAY BE EITHER 115 OR 230V PER ORDER SPECIFICATIONS
DTFD MAY BE 115 OR 230V PER ORDER SPECIFICATIONS

KYSOR | WARREN // SHERER
DIVISION OF KYSOR INDUSTRIAL CORPORATION

HOT GAS WIRING - WPG, SPG, SVG UNITS

DATE: 1-17-84

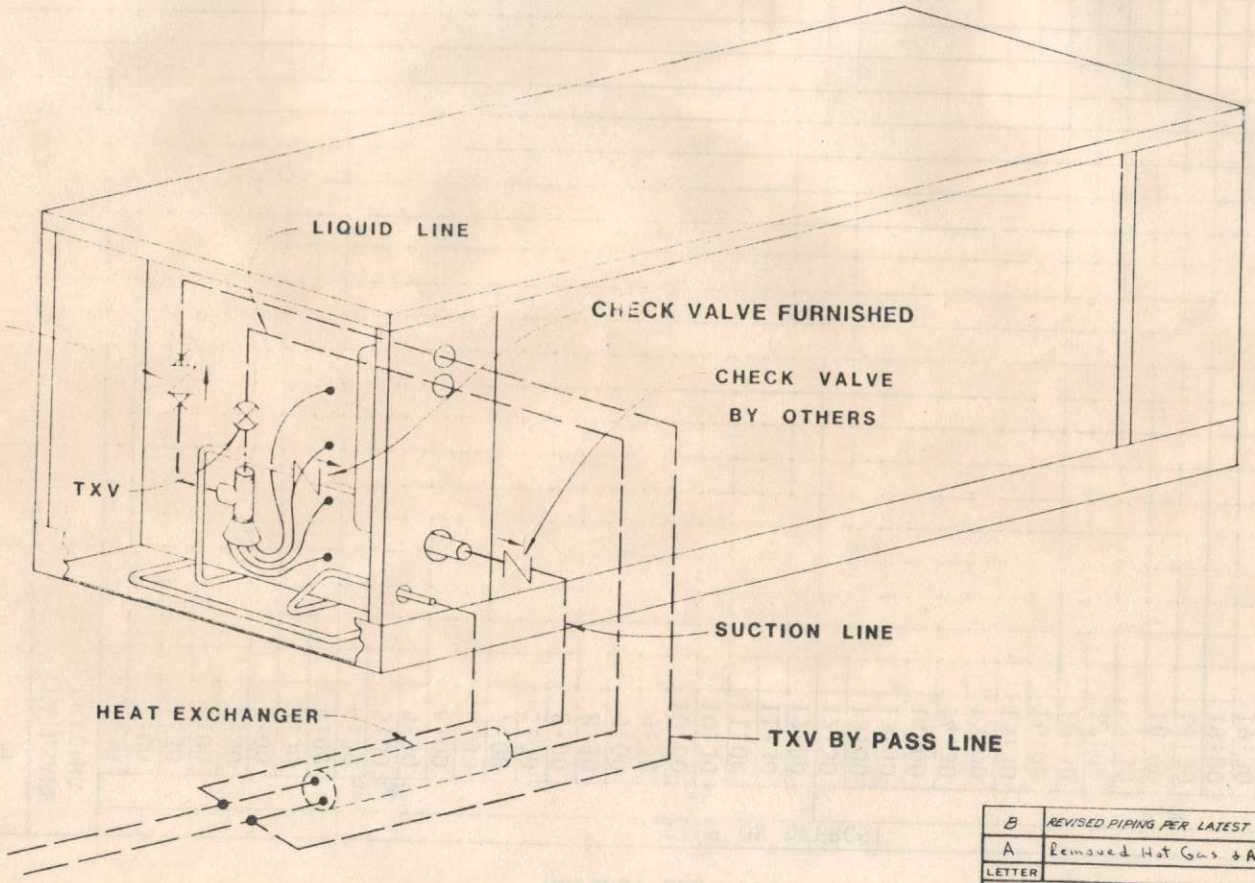
DRAWN BY

DRAWING NUMBER 107258

TOLERANCES UNLESS OTHERWISE NOTED FRACT. ± DEC. ±

DNEBCO

PIPING BY OTHERS — — — —



LETTER	REVISED	DATE	BY
B	REVISED PIPING PER LATEST RUSSELL DRAWING	6-4-84	DK
A	Removed Hot Gas & Arrow	5/25/83	PMC

DATE 5-4-83
SCALE NONE
DRAWN D.S. KWAK
APPD. [illegible]

TITLE
Hot Gas System
REVERSE CYCLE

KYSOR WARREN / SHERER
DIVISION OF KYSOR INDUSTRIAL CORPORATION

DRAWING NUMBER
PB-21853

WARREN / SHERER

Dual Metic System

DEFROST SCHEDULE

| UNIT NO. | CIRCUIT NO. | FIXTURE | FAILSAFE SETTING | TIME OF DEFROST | | |

RECOMMENDED PIPING PRACTICES FOR WARREN/SHERER CASES

7/25/80
Rev. 7/25/85

1. Proper size refrigeration lines are essential to good refrigeration performance. Suction lines are more critical than liquid or discharge lines. Oversized suction lines may prevent proper oil return to the compressor. Undersized lines can rob refrigeration capacity and increase operating cost. Consult the technical manual or legend sheet for proper line sizes.

2. Refrigeration lines in cases in line-ups can be reduced. However, the lines should be no smaller than the main trunk lines in at least 1/3 of the cases and no smaller than one size above the case lines to the last case. Reductions should not exceed one line size per case. It is preferred to bring the main trunk lines in at the center of line-up. Liquid lines on systems on hot gas defrost must be increased one line size above the main trunk line for the entire line-up. Individual feed lines should be at the bottom of the liquid header.

3. Do not run refrigeration lines from one system through cases on another system.

4. Use dry nitrogen in lines during the brazing to prevent scaling and oxidation.

5. Insulate suction lines from the cases to the compressor with 3/4" wall thickness Armaflex or equal on low temp cases to provide maximum of 65 Deg. superheated gas back to the compressor and prevent condensation in exposed areas. Insulate suction lines on medium temp cases with 1/2" thick insulation in exposed areas to prevent condensate drippage.

6. Suction and liquid lines should never be taped or soldered together. Adequate heat exchanger is provided in the case.

7. Refrigeration lines should never be placed in the ground unless they are protected against moisture and electrolysis attack.

8. Always slope suction lines down toward the compressor, 1/2" each 10'. Do not leave dips in the line that would trap oil.

9. Provide "P" traps at the bottom of suction line risers, 4' or longer. Use a double "P" trap for each 20' of risers. "P" traps should be the same size as the horizontal line. Consult the technical manual or legend sheet for proper size risers.

10. Use long radius ells and avoid 45 Deg. ells.

11. Provide expansion loops in suction lines on systems on hot gas defrost. See Engineering Bulletin #85-204-3 for detail.

12. Strap and support tubing to prevent excessive line vibration and noise.

13. Brazing of copper to copper should be with a minimum of 10% silver. Copper to brass or copper to steel should be with 45% silver.

14. Avoid the use of "bull head" tees in suction lines. An example is where suction gas enters both ends of the tee and exits the center. This can cause a substantial increase in pressure drop in the suction lines.

15. When connecting more than one suction line to a main trunk line, connect each branch line with an inverted trap.

KYSOR® Warren-Sherer
DIVISION OF KYSOR INDUSTRIAL CORPORATION

1600 Industrial Blvd., P.O. Box C, Conyers, Georgia 30207-0019 Phone: (404) 483-5600 TWX: 810-766-4172

Technical Bulletin #85-204-3

Subject: Expansion Loops - Gas Defrost

On a refrigeration system with gas defrost, the refrigerant lines expand and contract with temperature changes. The suction line will normally have the greatest movement since it has the largest temperature change during defrost.

If this expansion and contraction is not planned for during the installation of refrigerant lines, kinking and breaking of the lines could occur.

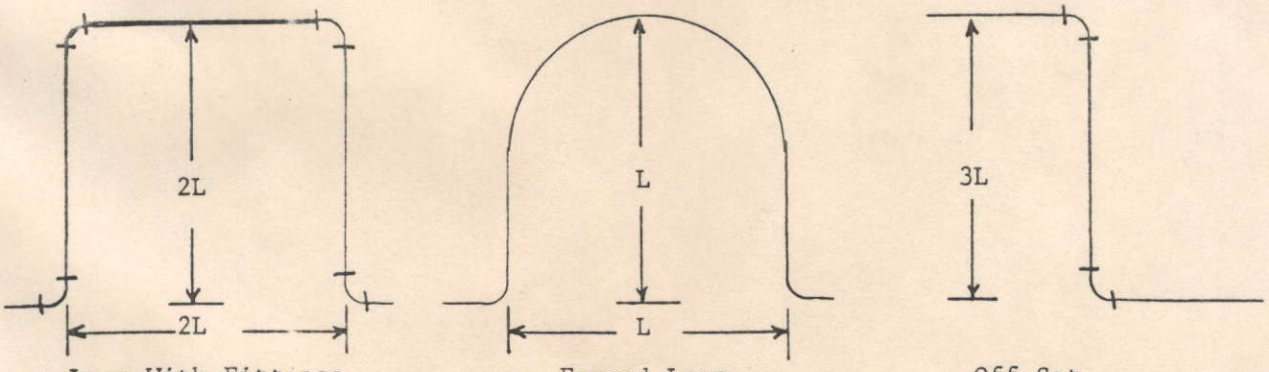
In order to compensate for the expansion of the tubing, it is necessary to estimate the amount of expansion and then provide offsets or loops in the refrigerant piping. As a general rule, medium temperature lines will expand approximately 1-1/2" for each 100 feet and low temperature lines approximately 2" for each 100 feet of tubing.

Normally, in a supermarket, the area to be most concerned with is the straight line distance from the fixture to the main access pit in or near the motor room.

In compensating for expansion and contraction, two items are very important.

1. Liquid and suction lines cannot be joined together and should not touch at any point.
2. Pipe hangers must be located and installed in such a manner as not to restrict the expansion and contraction of the tubing. All tubing clamps should have an insulation material (ie hydra sorb bushing) to prevent metal to metal contact.

Typical Expansion Control Methods



Loop With Fittings | Formed Loop | Off Set

Expansion Chart

Ref. Line	Length - L (inches) Amount of Expansion								
O.D.	1/2	1	1-1/2	2	2-1/2	3	4	5	6
7/8	10	15	19	22	25	27	30	34	38
1-1/8	11	16	20	24	27	29	33	38	42
1-3/8	11	17	21	26	29	32	36	42	47
1-5/8	12	18	23	28	31	35	39	46	51
2-1/8	14	20	25	31	34	38	44	51	57
2-5/8	16	22	27	32	37	42	47	56	62

Example: Expansion Loop Calculation

Medium Temperature
Line Length 225'
Line Size 1-5/8"

Amount of Expansion = $\frac{200}{100}$ x 1.5"/100 Ft = 3"

Based on 3" expansion and 1-5/8" tubing, the legs of the loop would be 2 times L Valve or 2 x 35 = 70" each.

Low temperature lines would be calculated in a similar manner.

By utilizing proper methods to allow for expansion and contraction of refrigerant lines, the reliability of systems with gas defrost is enhanced greatly.

Paul Renaud

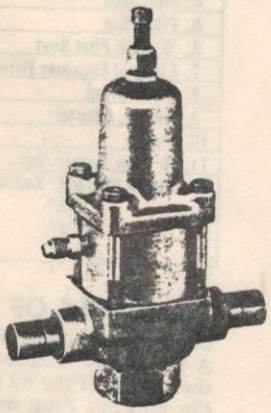
PR:jf

3/13/85

Hot Gas Bypass Regulator

HOT GAS BYPASS REGULATORS
FOR SYSTEM CAPACITY CONTROL
TYPES A9, A9E, A9S and A9SE for R-12, R-22 and R-502

BULLETIN 25-95C
TYPE A9



A9E

December, 1980
Installation Service and Parts Information

FEATURES—

- Controls Outlet Pressure at Sensing Point
- Pilot Operated for Close Regulation
- Few Sizes Cover Entire Capacity Range
- External or Internal Equalizer
- Available With Integral Electric Shut-Off
- Tight Seating • Simple Adjustment
- Sweat End Design Solders into Line Without Disassembly
- Cleanable in Line • Nominal Capacities 1.3 to 24 Tons
- UL Listed • 400 PSIG Safe Operating Pressure
- CSA Certified

DESCRIPTION—

These ductile iron bodied regulators with brazed copper couplings are used to modulate the flow of refrigerant gas to maintain a nearly constant outlet pressure at the sensing point. The regulators are pilot operated. The unique design allows the regulators to be soldered into the line without disassembly, yet allows disassembly of the valve for cleaning and maintenance without removing the regulator from line.

NOMINAL CAPACITIES

mm	inches	Type	Shipping Wt.† lbs.	Shipping Wt.† kg.	Nominal Capacity* Tons R-12	Tons R-22	Tons R-502	1000 kcal/hr R-12	1000 kcal/hr R-22	1000 kcal/hr R-502
15 Red.	5/8" Red.	A9E	3.0	1.4	1.3	2.2	2.2	4.2	7.4	6.7
15	5/8"	A9E	3.0	1.4	4	7	7	13	23	21
22	7/8"	A9E	3.3	1.5	8	15	14	21	48	44
28	1-1/8"	A9E	3.3	1.5	13	24	22	40	75	68

*Capacities for 40 °C (100 °F) Cond'g. Temp. and 70 °C (160 °F) Disch. Temp. See also Bulletin BYG.
†Add 0.5 lbs. (0.2 kg) for A9S and A9SE.

WHEN YOU ORDER—

Please give valve size and type, and pressure range. If internally equalized is required specify the Type A9, otherwise externally equalized A9E will be supplied as standard. Standard outlet pressure Range A, 10" Hg. vacuum to 120 psig will be furnished unless otherwise specified. Range B, 80 to 220 psig is available at no extra charge. Pilot electric shut-off is available: specify A9S or A9SE and coil voltage and cycles.

PURPOSE—

The A9 Hot Gas Bypass Regulators modulate the flow of refrigerant gas to maintain a nearly constant pressure at the sensing point at the outlet of the regulator. The regulator allows loading of the system to eliminate short cycling of the compressors, provide required humidity control, and proper oil return.

OTHER USES—

- Booster Suction Control to Prevent Deep Vaccum
- Air Cooled Condenser Control
- Hot Gas Defrost Control
- Liquid Pressure Control
- Contact Factory for Special Uses

SELECTION INFORMATION—

Above table gives nominal capacities. Please see page 4 for typical applications, and Bulletin BYG for detailed application and selection information.

INTERNALLY EQUALIZED—

This regulator is normally furnished as A9E externally equalized. The outlet pressure being controlled is that pressure at the external equalizer connection. In many applications where it is acceptable to control the pressure at the outlet of the regulator, an internally equalized regulator should be used. In this instance, the A9 should be ordered.

NOTE: A9E or A9SE can not be converted to A9 or A9S without replacing the #22 adapter.

ELECTRIC SHUT-OFF—

For pump-down control the regulator must be electrically shut-off. Specify A9S or A9SE "with pilot electric shut-off" and specify voltage and frequency. Alternately, a separate full size solenoid valve can be used upstream of the regulator for shut-off.

INSTALLATION—

The regulator can be mounted in a horizontal or vertical line with the flow in the direction of the arrow on the valve body. The adjusting stem should not be located below the centerline of the valve. The valve should be installed in a manner that avoids trapping condensed refrigerant in the valve.

Protect the inside of the regulator from moisture, dirt and chips during installation. These regulators may be soldered into the line without disassembly. A wet cloth should be wrapped around the valve and the soldering flame should be directed away from the valve body.

PARTS LIST A9, A9E, A9S, A9SE

Description	Part No.	Qty.	Description	Part No.	Qty.	Description	Part No.	Qty.
1. Spring Rest	24-1048-03	1	13. Spring, Piston Plug	80-1000-05	1	24. Bonnet Bolts A9, A9E	90-1000-56	4
2. Bonnet Spring Range A	80-1001-08	1	14. Diaphragm Range A	24-1088-00	2	A9S, A9SE	90-1001-63	4
Range B	80-1001-09	1	Range B	24-1088-00	3	25. Valve Body Assem. 5/8"	24-0108-00	1
3. Diaphragm Follower	24-1018-02K	1	15. Gasket, Bonnet	81-1001-38	1	7/8"	24-0109-00	1
4. Pilot Seat	24-1016-00	1	16. 'O' Ring, Diaphragm	93-1000-64	1	1-1/8"	24-0110-00	1
5. Pilot Plug	24-1015-00	1	17. Adjusting Stem	90-1000-77	1	26. Bottom Cap	24-1013-02K	1
6. 'O' Ring, Pilot Seat	93-1000-58	1	18. Seal Nut	90-1000-15	1	27. Operator Repair Kit	83-1000-77	1
7. External Equalizer Fitting	92-1000-64	1	19. Bonnet	24-1086-11K	1	28. Cover Retaining Clip	83-1000-76	1
8. Pilot Spring	80-1000-54	1	20. Label	24-1114-00	1	29. Coil 120/60 †	83-1000-25	1
9. Gasket, Adapter	81-1001-22	1	21. Label	24-1115-00	1	Coil 240/60	83-1000-26	1
10. Piston	24-1034-00K	1	22. Adapter A9	24-1011-22	1			
11. 'O' Ring, Bottom Cap	93-1000-52	1	A9E	24-1011-21	1	† For other Coils specify voltage and cycles		
12. Piston Plug 5/8" Reduced	24-1017-04K	1	A9S	24-0157-02	1			
5/8"	24-1017-03K	1	A9SE	24-0157-00	1	NOTE: When ordering parts specify valve type and size		
7/8"	24-1017-01K	1	23. Label	24-1041-01	1			
1-1/8"	24-1017-02K	1						

PRINCIPLES OF OPERATION —

Control pressure is transmitted through #7 Fitting to space A under #14 Diaphragm. When this pressure is lower than the setting of the #2 Spring, this spring force pushes against the #5 Pilot Plug moving it off the #4 Pilot Seat and the inlet pressure is transmitted from area X through passage N, pilot seat, and passage D to the chamber on top of #10 Piston. The difference in this pressure and the pressure in space M causes the Piston to move the #12 Piston Plug off its seat allowing flow from inlet space X to outlet space B, increasing the control pressure.

As the control pressure increases, the #14 Diaphragm moves against the force of #2 Spring, allowing the #5 Pilot Plug start to close and reduce the flow to the top of #10 Piston. The pressure on top of the piston bleeds to the space M and the force of #13 Spring causes the #12 Piston Plug to move towards closed position, thus reducing the flow through the valve and correcting the control pressure.

In case of the internally equalized A9 the control pressure is sensed at the valve outlet and transmitted through passage P.

When a solenoid shut-off feature is used, the passage N is open only when the solenoid is energized.

During operation, the Main Valve will assume an intermediate or throttling position with respect to the regulator setting. A properly sized A9E Hot Gas Bypass Regulator will control to within 1/2 to 5 pounds of the pressure setting depending on the system operating characteristics and the sizing of the regulator.

ADJUSTMENT —

Install an accurate pressure gauge at the control (sensing) point at the outlet side of the valve.

To adjust the valve, loosen #18 Seal Nut and turn the #17 Adjusting Stem clockwise to raise the pressure or counterclockwise to lower the pressure. For Range A one turn equals approximately 16 psi (1.1 kg/cm²); for Range B one turn equals approximately 25 psi (1.8 kg/cm²).

The regulator should be set under actual operating conditions. For hot gas bypass this condition occurs under minimal system load conditions. The regulator should be adjusted to maintain minimum desired suction pressure. Hot gas flow through the valve can be detected by listening to the gas flow through the regulator or by feeling the outlet pipe for warmth. When it is not possible to simulate minimum load conditions, an approximate setting may be obtained by adjusting the valve until gas flow begins, observing the gauge reading, and then turning the adjusting stem counterclockwise for the required number of turns to obtain the desired minimum pressure. This setting should be checked and readjusted as needed under actual conditions.

SERVICE POINTERS —

1. Failure to regulate: (a) #10 Piston may be jammed due to excessive dirt. This is the most likely cause of any regulator difficulties even when the regulator is preceded by a strainer. Remove #24 Bolts. Remove #22 Adaptor. Push down on #10 Piston against the returning #13 Plug Spring Force. Piston should move freely down and should be returned by the #13 Plug Spring Force. If jammed or sticky, remove #26 Bottom Cap and push up #12 Piston Plug from the bottom with the blunt end of a wood pencil or similar tool. #10 Piston should now pop free from #25 Body. Remove #12 Piston Plug by pushing from top to remove from the bottom. Clean all removed parts thoroughly. If jamming has occurred, remove all burrs from #10 Piston, #12 Piston Plug and Cylinder Wall with fine crocus cloth. Reassemble the regulator with a light coating of refrigeration oil on all parts. (b) #5 Pilot Plug may be dirty or eroded (inspect and replace if necessary). Remove #5 Pilot Plug by removing #4 Pilot Seat with a 5/8" socket. (c) #14 Diaphragm may be broken or eroded (inspect and replace if necessary). (d) #14 Diaphragm may not be receiving downstream pressure. In the case of an A9E external equalized regulator, the pipe leading to a downstream source may be blocked by dirt or a closed valve. In the case of an A9 internally equalized regulator, passage P may be blocked by dirt.

2. Failure to open: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not opening; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned out so far that a lower downstream pressure may be required to open the regulator than can be created by the system. (Turn in the #17 adjusting stem.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure setting desired. This is most likely to occur when range B regulator is supplied. To correct, change #2 Spring. (d) In case of regulator with electric shut-off the solenoid may not be energized or coil may be burned out. Check electrical circuit to make sure the solenoid is energized. Replace #29 Coil if necessary.

3. Failure to close: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not closing; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned in so far that a higher pressure is opening the regulator than is desired in the system. (Turn out #17 adjusting stem) until the regulator closes at the desired pressure.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure desired. (Change #2 Diaphragm Spring.) (d) #5 Pilot Plug may be dirty or eroded (inspect and replace if necessary); see 1 (b). (e) #14 Diaphragm may be broken or eroded (inspect and replace if necessary); see 1 (c). (f) In case of regulator with solenoid shut-off the regulator should close when the solenoid coil is de-energized. Check electrical circuit to make sure no power is applied to the solenoid coil. Remove solenoid tube and check teflon seat for damage. Replace internal parts using #27 Operator Repair Kit if necessary.

4. Hunting: Under light load conditions, a system may hunt. Unless the hunting is adversely affecting temperatures or bothering the performance of the equipment, the hunting itself should be ignored. If very serious, the matter should be looked into further.

The Hot Gas Bypass Regulator is sometimes blamed if the system seems to hunt. The A9E regulator was especially designed with a characterized plug to give controlled flow over its entire hot gas flow range. For this reason, we suggest that the other elements and control valves in the system be critically examined if there appears to be intolerable hunting.

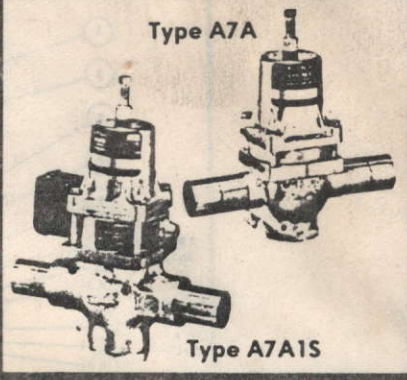
The following action is recommended: (a) If bypass with liquid injection is used, refer to BYG Bulletin for correct TXV size. (b) Examine TXV's; are they operating below 50% of capacity? If so, use one of the methods recommended

PRESSURE REGULATORS

BULLETIN 25-91F
TYPE A7

COMPACT WIDE-RANGE PRESSURE REGULATORS FOR EVAPORATOR, HEAT RECLAIM, AND HEAD PRESSURE CONTROL

TYPE
A7A, A7AI, A72
15 mm (⅝")
to
66 mm (2⅝")



March 1980
Installation, Service and Parts Information

FEATURES

- Dual spring for wide range pressure set-points
- Pilot operated for close control at desired set-point
- V-port design means excellent regulation
- Disc piston • Teflon seat
- Low pressure drop • Few moving parts
- Long-life diaphragms; no bellows to fail
- Variations available for pilot electric shut-off, pilot electric wide-opening, and differential pressure control
- UL Listed • CSA Certified
- Manual opening feature on A7A1 and A72

SPECIFICATIONS

- Design pressure: 28 kg/cm² (400 psig)
- Range: 250 mm hg to 28 kg/cm² (10" hg to 400 psig)
- Nominal capacity: 1500 to 121,000 kcal/h (.5 to 40 tons)

DESCRIPTION

These ductile iron bodied regulators with brazed copper couplings are used to modulate the flow of refrigerant gas to maintain a constant inlet pressure. The unique design allows the regulators to be soldered into the line without disassembly, yet allows disassembly for cleaning and maintenance without removing from the line.

The A7 Series of Regulators is available with the following variations: Electric Shut-off ("S"), Electric Wide-opening ("B"), Differential Pressure Regulation ("L") and combination Electric Wide-opening and Differential Pressure Regulation ("BL"). The "BL" variation is available in the A7A1 and A72 Series only.

All A7 Regulators (except "L" and "BL") feature the wide range pressure setting, Range A/D, 250 mm to 28 kg/cm² (10" hg to 400 psig). The "L" and "BL" versions feature a *differential* pressure setting of 0 to 6.3 kg/cm² (0 to 90 psig).

PURPOSE

The A7 Series Compact Wide Range Pressure Regulator modulates flow of refrigerant to maintain a constant inlet (evaporator, condenser, heat reclaim coil, or discharge line) pressure as set-for, despite fluctuations in load. The regulator will open when the inlet pressure begins to rise above its setting and will close when the inlet pressure begins to fall below its setting. The regulator cannot lower inlet (evaporator) pressure below the outlet (compressor suction) pressure. Outlet pressure, of course, depends upon the capacity of the compressor.

Types A7A, A7A1 and A72 control inlet pressure according to a field adjustable set-point.

Types A7AS, A7A1S and A72S control inlet pressure when pilot solenoid is energized or shut off when de-energized.

Types A7AB, A7A1B and A72B control inlet pressure when pilot solenoid is de-energized or are wide-open when energized.

Types A7AL, A7A1L and A72L control pressure difference across regulator.

Types A7A1BL and A72BL con ol pressure difference across regulator when pilot solenoid is de-energized or are wide-open when energized.

INSTALLATION

On the Types A7A and A7A1 Series Regulators, the proper direction of flow is designated by an arrow cast into the side of the valve body, pointing from inlet to outlet. On the Type A72 Series Regulators, the proper direction of flow is designated by words "in" and "out" cast into the side of the body flange adjacent to #27 Valve Cover. The proper direction of flow is also shown by a red arrow on the Valve Bottom Cap of all A72 regulators.

The regulator should be mounted in a horizontal or vertical pipe line with direction of flow as described above. As with all pressure regulators, these compact regulators can control flow in this normal direction only. If a change in system operating conditions causes the outlet pressure to rise sufficiently above the inlet pressure, the #18 (#28 on A72) Main Valve Assembly will be blown down from its seat and reverse flow will occur. This is often accompanied by a clicking noise.

Protect the inside of the regulator from moisture, dirt, chips and solder beads during installation. These compact regulators may be soldered into the line without disassembly if reasonable precautions are taken. The flame from the soldering torch should be directed away from the valve body to avoid excessive heat build-up which could possibly damage some of the internal parts. As an additional precaution, a wet cloth should be wrapped around the regulator body to dissipate some of the heat during the soldering operation.

ADJUSTMENT

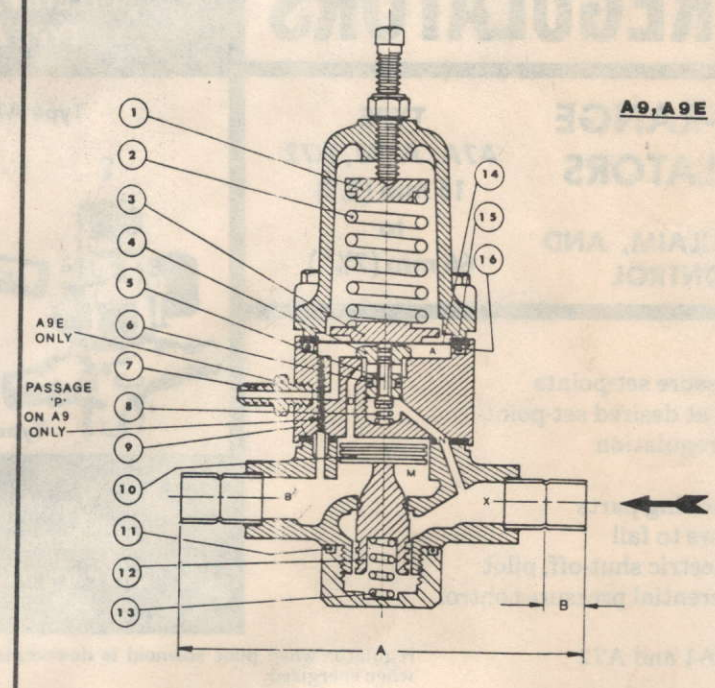
Before adjusting, connect an accurate gauge to the gauge port of the regulator or at the evaporator. A gauge at the regulator is usually more convenient. The adjustment of a regulator with the L or the BL variation will also require a gauge to measure the pressure connected to the Bonnet. It is desirable to install either a gauge valve or a Schrader type valve in some of the ¼" regulator gauge ports before the system is charged with refrigerant.

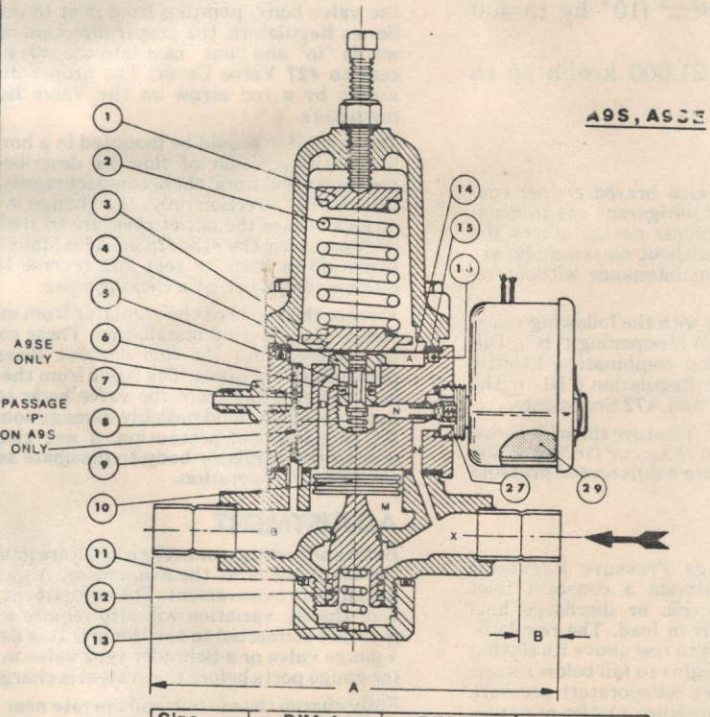
Fully charge the system and operate near the normal design conditions. To lower the control pressure, loosen the Seal Nut #2 or #18 then turn the #1 or #16 Adjusting Stem out (counterclockwise).

Between 0 and 6.3 kg/cm² (90 psig), one complete turn of the Adjusting Screw will change the inlet pressure approximately 4.9 kg/cm² (20 psi). Between 6.3 kg/cm² (90 psig) and 28 kg/cm² (400 psi), one complete turn of the Adjusting Screw will change the inlet pressure 4.9 kg/cm² (70 psi).

Caution: Regulators with B or BL variations can be adjusted only with the pilot solenoid de-energized.

(continued on last page)





Size	DIM A		DIM B		Net Weight*	
	Inches	MM	Inches	MM	Lbs.	Kg.
5/8 Red.	5.25	133	0.5	13	2.5	1.1
5/8	5.25	133	0.5	13	2.5	1.1
7/8	6.19	157	0.75	19	2.75	1.2
1-1/8	6.87	175	0.94	24	3	1.3

*Add 0.5Lb (.2Kg) for A9S, A9SE

INSTALLATION OF VALVE:
IN A HORIZONTAL LINE, LOCATE ADJUSTING STEM 17 AT TOP OR SIDE BUT NOT BELOW CENTERLINE.

TO RAISE PRESSURE SETTING:
LOOSEN SEAL NUT 18 AND TURN ADJUSTING STEM 17 CLOCKWISE.

REV B 7/74

FOR R-12, R-22 and R-502

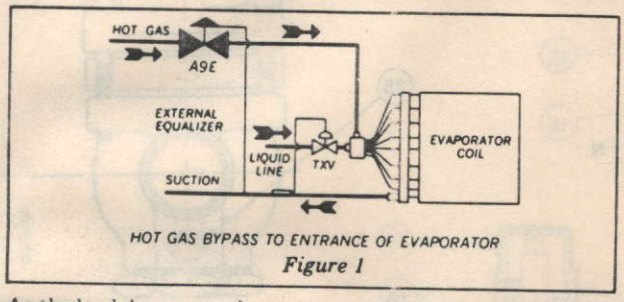
Refrigerating Specialties Division
2445 S. 25TH Ave., Broadview, Il USA

HOT GAS BY-PASS REGULATOR

DRAWN BY	TYPE A9, A9E, A9S, A9SE	
APPROVED	DATE 9-74	DWG NO 4075

by TXV manufacturers for this type operation. (c) Increase superheat of TXV liquid injection valve by adjusting, or installing new charge. (d) Wrap bulb to dampen action of TXV liquid injection valve. (e) Check location of entrance of external equalizer connection to suction line in relation to TXV liquid injection bulb location. (f) If hot gas side inlet type of distributor is used, determine whether it is properly selected. (g) If "T" is used between main TXV and distributor for hot gas input, limit bypass tonnage to one-third of capacity of distributor. (h) Check with TXV manufacturer for proper TXV charge. (i) Determine if the A9E used for the job is oversized for the actual maximum load conditions; if so, use a smaller capacity plug. Piston plugs #12 are interchangeable on all sizes of A9 type regulators.

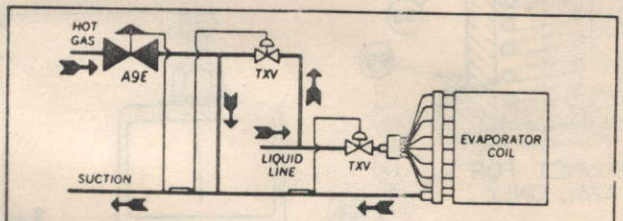
APPLICATION — (See Bulletin BYG)



HOT GAS BYPASS TO ENTRANCE OF EVAPORATOR

Figure 1

As the load decreases, the suction pressure decreases slightly. The Type A9E regulator, sensing the decrease through the external equalizer line, opens slightly to meter hot gas through the side inlet of the distributor into the evaporator coil. The desired suction pressure is thereby maintained within several psi without short cycling.



HOT GAS BYPASS TO SUCTION LINE

Figure 2

As the load decreases, the suction pressure decreases slightly. The Type A9E regulator, sensing the decreased outlet pressure, opens slightly to meter hot gas through the regulator to the suction. To remove the superheat from the bypassed gas, a liquid injection valve should be installed opposite the A9E regulator.

HELPING THE EPR —

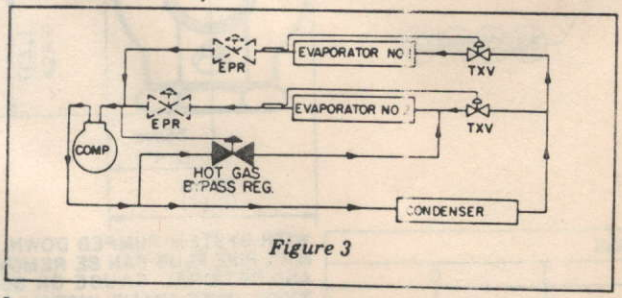


Figure 3

In many applications, an evaporator pressure regulator (EPR) does an excellent job of maintaining evaporator temperature control as loads are reduced. In other cases, the use of an EPR, either preset, compensated by air, by an electric motor, or by a temperature bulb, causes, or may encounter a greatly reduced evaporator load. Below the compressor unloader steps or when unloaders are not used, reduced evaporator loads cause the EPR to throttle, resulting in lower compressor suction pressures. This lowered pressure reduces compressor capacity at a rate of about 2% per psi drop. Unfortunately, such reduction is only practical over a limited range because of possible oil pumping, short cycling and erratic EPR performance at the excessive pressure drops. Frequently an EPR can be used satisfactorily by itself until suction pressure drops by more than 20 psi; below this a Hot Gas Bypass Regulator should be added through an evaporator or direct to the suction line with TXV liquid injection. The external equalizer of the Hot Gas Bypass Regulator must be on the suction side of any EPR which might be used. A typical arrangement is shown below in FIG. 3.

SPECIFICATIONS —

Design Pressure: 400 psig (28 kg/cm²).

Adjustment range: 10" Hg vac. to 120 psig (506 mm Hg to 8.4 kg/cm²) and 80 psig (4.2 kg/cm²) to 220 psig (15.5 kg/cm²).

Minimum pressure drop to open valve completely: 10psi (0.7 kg/cm²)

Maximum pressure change from valve closed to completely open: 5 psi (0.35 kg/cm²)

Minimum Refrigerant Temperature: —50° F (—45° C)

Maximum Refrigerant Temperature: 200° F (93° C)

Materials: Body: Ductile iron with silver brazed copper couplings; Piston, Piston Plug, Pilot Seat, Pilot Plug: Stainless Steel; Springs: Steel or Stainless Steel; Diaphragms: Steel; Bonnet: Aluminum; Bottom Cap: Plated Steel; "O" Rings: Synthetic Rubber; Cap Screws: Plated Steel; Other Parts: Plated Steel.

SAFE OPERATION (See Bulletin RSB)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent product bulletins and the current Bulletin RSB prior to installation or servicing work.

WARRANTY —

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from the factory. This warranty is in force only when products are properly installed, maintained and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Division. Defective products, or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection will be replaced or repaired at Refrigerating Specialties' option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt, or other foreign substances will not be considered defective.

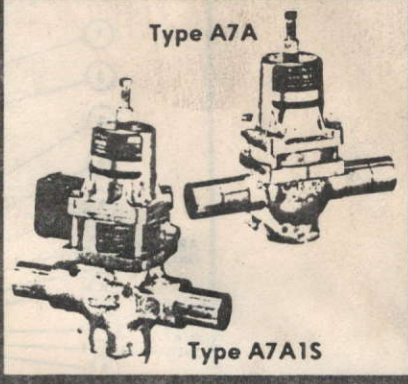
THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

PRESSURE REGULATORS

BULLETIN 25-91F
TYPE A7

COMPACT WIDE-RANGE PRESSURE REGULATORS FOR EVAPORATOR, HEAT RECLAIM, AND HEAD PRESSURE CONTROL

TYPE
A7A, A7AI, A72
15 mm (⅝")
to
66 mm (2⅝")



March 1980
Installation, Service and Parts Information

FEATURES

- Dual spring for wide range pressure set-points
- Pilot operated for close control at desired set-point
- V-port design means excellent regulation
- Disc piston • Teflon seat
- Low pressure drop • Few moving parts
- Long-life diaphragms; no bellows to fail
- Variations available for pilot electric shut-off, pilot electric wide-opening, and differential pressure control
- UL Listed • CSA Certified
- Manual opening feature on A7A1 and A72

SPECIFICATIONS

- Design pressure: 28 kg/cm² (400 psig)
- Range: 250 mm hg to 28 kg/cm² (10" hg to 400 psig)
- Nominal capacity: 1500 to 121,000 kcal/h (.5 to 40 tons)

DESCRIPTION

These ductile iron bodied regulators with brazed copper couplings are used to modulate the flow of refrigerant gas to maintain a constant inlet pressure. The unique design allows the regulators to be soldered into the line without disassembly, yet allows disassembly for cleaning and maintenance without removing from the line.

The A7 Series of Regulators is available with the following variations: Electric Shut-off ("S"), Electric Wide-opening ("B"), Differential Pressure Regulation ("L") and combination Electric Wide-opening and Differential Pressure Regulation ("BL"). The "BL" variation is available in the A7A1 and A72 Series only.

All A7 Regulators (except "L" and "BL") feature the wide range pressure setting, Range A/D, 250 mm to 28 kg/cm² (10" hg to 400 psig). The "L" and "BL" versions feature a *differential* pressure setting of 0 to 6.3 kg/cm² (0 to 90 psig).

PURPOSE

The A7 Series Compact Wide Range Pressure Regulator modulates flow of refrigerant to maintain a constant inlet (evaporator, condenser, heat reclaim coil, or discharge line) pressure as set-for, despite fluctuations in load. The regulator will open when the inlet pressure begins to rise above its setting and will close when the inlet pressure begins to fall below its setting. The regulator cannot lower inlet (evaporator) pressure below the outlet (compressor suction) pressure. Outlet pressure, of course, depends upon the capacity of the compressor.

Types A7A, A7A1 and A72 control inlet pressure according to a field adjustable set-point.

Types A7AS, A7A1S and A72S control inlet pressure when pilot solenoid is energized or shut off when de-energized.

Types A7AB, A7A1B and A72B control inlet pressure when pilot solenoid is de-energized or are wide-open when energized.

Types A7AL, A7A1L and A72L control pressure difference across regulator.

Types A7A1BL and A72BL con ›l pressure difference across regulator when pilot solenoid is de-energized or are wide-open when energized.

INSTALLATION

On the Types A7A and A7A1 Series Regulators, the proper direction of flow is designated by an arrow cast into the side of the valve body, pointing from inlet to outlet. On the Type A72 Series Regulators, the proper direction of flow is designated by words "in" and "out" cast into the side of the body flange adjacent to #27 Valve Cover. The proper direction of flow is also shown by a red arrow on the Valve Bottom Cap of all A72 regulators.

The regulator should be mounted in a horizontal or vertical pipe line with direction of flow as described above. As with all pressure regulators, these compact regulators can control flow in this normal direction only. If a change in system operating conditions causes the outlet pressure to rise sufficiently above the inlet pressure, the #18 (#28 on A72) Main Valve Assembly will be blown down from its seat and reverse flow will occur. This is often accompanied by a clicking noise.

Protect the inside of the regulator from moisture, dirt, chips and solder beads during installation. These compact regulators may be soldered into the line without disassembly if reasonable precautions are taken. The flame from the soldering torch should be directed away from the valve body to avoid excessive heat build-up which could possibly damage some of the internal parts. As an additional precaution, a wet cloth should be wrapped around the regulator body to dissipate some of the heat during the soldering operation.

ADJUSTMENT

Before adjusting, connect an accurate gauge to the gauge port of the regulator or at the evaporator. A gauge at the regulator is usually more convenient. The adjustment of a regulator with the L or the BL variation will also require a gauge to measure the pressure connected to the Bonnet. It is desirable to install either a gauge valve or a Schrader type valve in some of the ¼" regulator gauge ports before the system is charged with refrigerant.

Fully charge the system and operate near the normal design conditions. To lower the control pressure, loosen the Seal Nut #2 or #18 then turn the #1 or #16 Adjusting Stem out (counterclockwise).

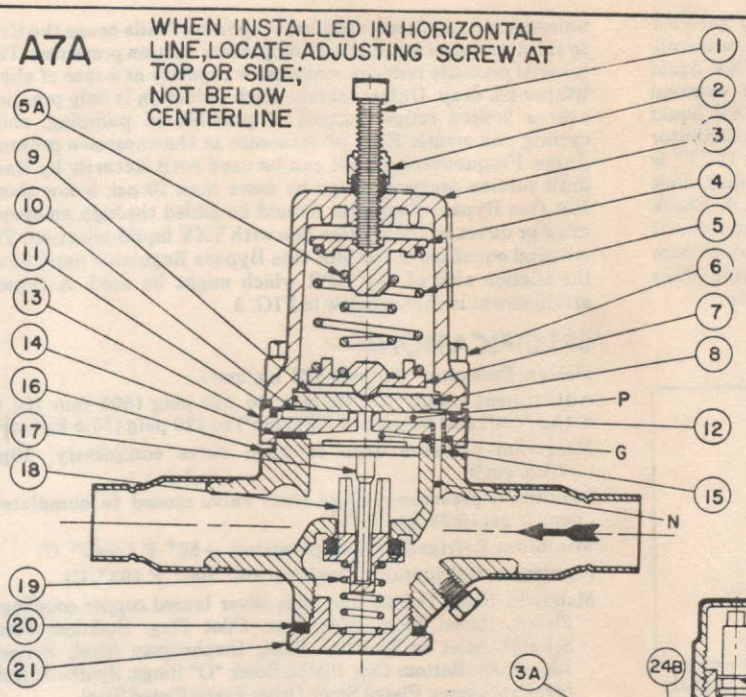
Between 0 and 6.3 kg/cm² (90 psig), one complete turn of the Adjusting Screw will change the inlet pressure approximately 4.9 kg/cm² (20 psi). Between 6.3 kg/cm² (90 psig) and 28 kg/cm² (400 psi), one complete turn of the Adjusting Screw will change the inlet pressure 4.9 kg/cm² (70 psi).

Caution: Regulators with B or BL variations can be adjusted only with the pilot solenoid de-energized.

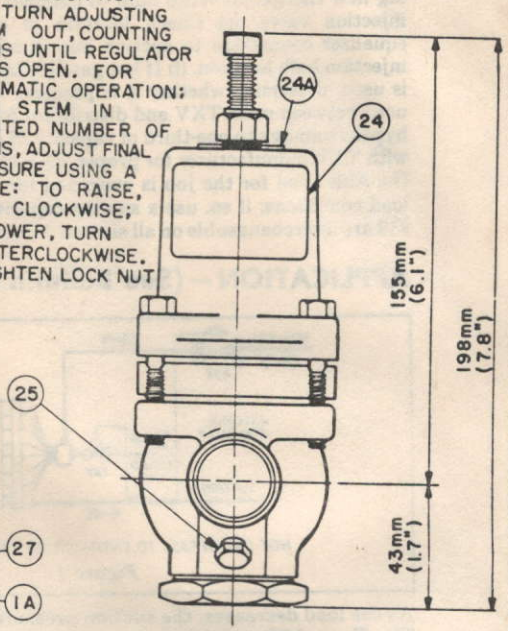
(continued on last page)

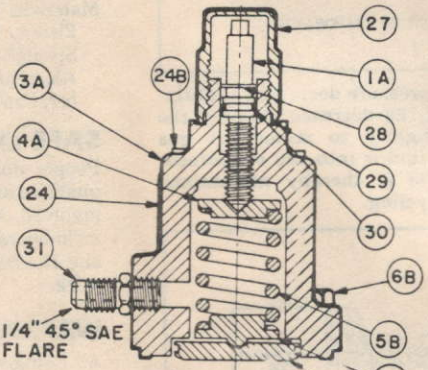
A7A

WHEN INSTALLED IN HORIZONTAL LINE, LOCATE ADJUSTING SCREW AT TOP OR SIDE; NOT BELOW CENTERLINE



TO MANUALLY OPEN. LOOSEN LOCK NUT AND TURN ADJUSTING STEM OUT, COUNTING TURNS UNTIL REGULATOR STAYS OPEN. FOR AUTOMATIC OPERATION: TURN STEM IN COUNTED NUMBER OF TURNS, ADJUST FINAL PRESSURE USING A GAUGE: TO RAISE, TURN CLOCKWISE; TO LOWER, TURN COUNTERCLOCKWISE. RETIGHTEN LOCK NUT

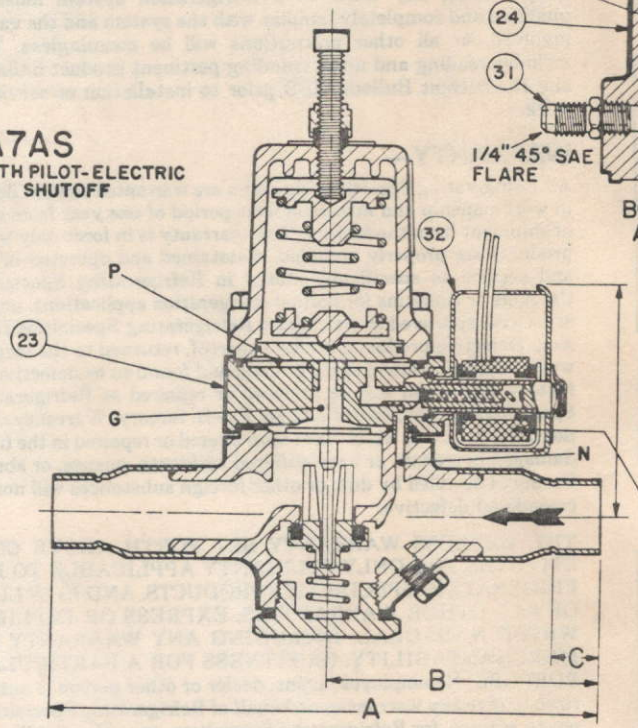


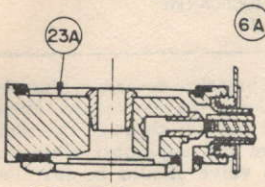


BONNET FOR A7AL ONLY

A7AS

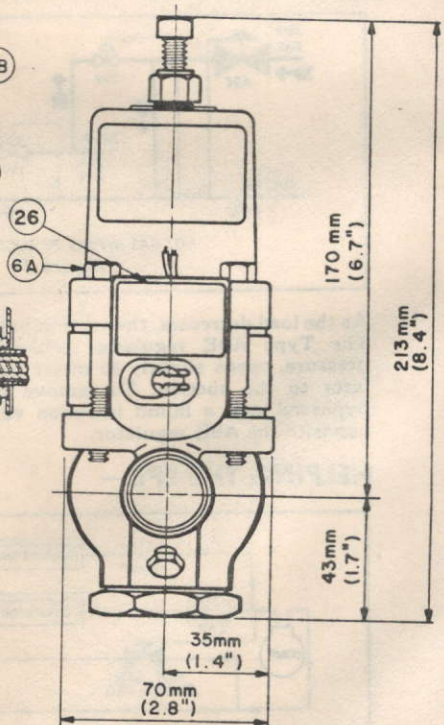
WITH PILOT-ELECTRIC SHUTOFF





ADAPTER FOR A7AB ONLY

33 33A 33B 33C



REGULATOR SIZE		NET WT. *	DIMENSIONS					
			A		B		C	
inch.	mm.		inch.	mm.	inch.	mm.	inch.	mm.
5/8	15	4 lbs. 1.8 kg.	7.3"	186	3.7"	93	0.5"	13
7/8	22	4 lbs. 1.8 kg.	7.3"	184	3.6"	92	0.8"	19
1-1/8	28	4 lbs. 1.8 kg.	7.3"	186	3.7"	93	1.0"	25

* ADD 1.8 lbs. (.8 kg.) FOR "S" & "B" VARIATION

REV E 2-22-80

WITH SYSTEM PUMPED DOWN, NO.25 N.P.T. PIPE PLUG CAN BE REMOVED AND OPTIONAL GAUGE OR SCHRADER TYPE GAUGE VALVE INSTALLED FOR INLET PRESSURE READING.

FOR R-12, R-22, R-502

COMPACT WIDE RANGE PRESSURE REGULATOR		
Drawn By J.E. BROWN	A7A, A7AS, A7AB & A7AL	
Approved By	Date 12-13-76	Dwg. No. 4052

A7A1, A7A1S, A7A1B, A7A1L and A7A1BL Parts List—Range A/D

Note: A7A1L & A7A1BL available in Range A only

Item	Description	Qty	Used On					Part Numbers		
			A7A1	S	B	L	BL	28 mm (1⅛")	35 mm (1⅜")	4[illegible]mm (1⅝")
1	Adjusting Stem, Range A/D	1	X	X	X			90-1002-14	90-1002-14	90-1002-14
1A	Adjusting Stem, Range A	1				X	X	24-1111-00K	24-1111-00K	24-1111-00K
2	Seal Nut	1	X	X	X			90-1000-15	90-1000-15	90-1000-15
3	Valve Bonnet	1	X	X	X			24-1126-11K	24-1126-11K	24-1126-11K
3A	Valve Bonnet	1				X	X	24-1110-11K	24-1110-11K	24-1110-11K
4	Spring Rest, Upper, Range A/D	1	X	X	X			24-1131-00	24-1131-00	24-1131-00
4A	Spring Rest, Upper, Range A	1				X	X	24-1048-01	24-1048-01	24-1048-01
5	Diaphragm Spring (Outer)	1	X	X	X			80-1001-57	80-1001-57	80-1001-57
5A	Diaphragm Spring (Inner)	1	X	X	X			80-1001-58	80-1001-58	80-1001-58
5B	Diaphragm Spring, Range A	1				X	X	80-1000-25	80-1000-25	80-1000-25
6	Bonnet Screw	4	X	X	X	X	X	90-1001-78	90-1001-78	90-1001-78
7	Spring Rest, Lower Range A/D	1	X	X	X			24-1130-00	24-1130-00	24-1130-00
7A	Spring Rest, Lower, Range A	1				X	X	40-1026-00	40-1026-00	40-1026-00
8	"O" Ring, Follower ①	1	X	X	X			93-1000-64	93-1000-64	93-1000-64
9	Diaphragm Follower	1	X	X	X			24-1132-00K	24-1132-00K	24-1132-00K
9A	Diaphragm Follower	1				X	X	22-1032-00K	22-1032-00K	22-1032-00K
10	Diaphragm ②	1	X	X	X	X	X	21-1007-04	21-1007-04	21-1007-04
11	Gasket, Bonnet ① ②	1	X	X	X	X	X	81-1001-33	81-1001-33	81-1001-33
12	"O" Ring, Bonnet ① ②	1	X	X	X	X	X	93-1000-57	93-1000-57	93-1000-57
13	Adapter Assembly	1	X			X		24-0170-00K	24-0170-00K	24-0170-00K
14	Gasket, Body ①	1	X	X	X	X	X	81-1001-60	81-1001-60	81-1001-60
15	Locating Pin	1	X	X	X	X	X	91-1000-52	91-1000-52	91-1000-52
16	Valve Body Assembly	1	X	X	X	X	X	24-0102-03	24-0103-03	24-0112-03
17	Valve Stem & Disc Assembly	1	X	X	X	X	X	24-0147-01K	24-0147-01K	24-0147-01K
18	Main Valve Assembly	1	X ③	X ③	X	X	X	24-0105-00K	24-0117-00K	24-0117-00K
19	Closing Spring	1	X	X	X	X	X	80-1001-38	80-1001-38	80-1001-38
20	"O" Ring, Bottom Cap ①	1	X	X	X	X	X	93-1000-63	93-1000-63	93-1000-63
21	Bottom Cap	1	X	X	X	X	X	24-1003-02K	24-1003-02K	24-1003-02K
23	Adapter Assembly	1		^				24-0171-00K	24-0171-00K	24-0171-00K
23A	Adapter Assembly	1			X		X	24-0171-01K	24-0171-01K	24-0171-01K
24	Nameplate	1	X	X	X	X	X	24-1114-01	24-1114-01	24-1114-01
24A	Nameplate—UL	1	X	X	X	X	X			
24B	Nameplate—Bypass	1	X	X	X	X	X	24-1134-00	24-1134-00	24-1134-00
25	Pipe Plug ⅛" NPT Hex Head	1	X	X	X	X	X	92-1001-21	92-1001-21	92-1001-21
26	Solenoid Nameplate	1		X	X		X	24-1041-01	24-1041-01	24-1041-01
27	Seal Cap	1				X	X	30-1173-00K	30-1173-00K	30-1173-00K
28	Retaining Ring	1				X	X	91-1000-34	91-1000-34	91-1000-34
29	Gasket, Seal Cap	1				X	X	81-1000-65	81-1000-65	81-1000-65
30	"O" Ring, Adjusting Stem	1				X	X	93-1000-58	93-1000-58	93-1000-58
31	¼" SAE Connector	1				X	X	92-1000-64	92-1000-64	92-1000-64
32	Solenoid Operator, Coil & Housing Assy. 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		X	83-1000-74	83-1000-74	83-1000-74
32A	Solenoid Operator, Coil & Housing Assy. 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		X	83-1000-75	83-1000-75	83-1000-75
33	Solenoid Coil 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		X	83-1000-25	83-1000-25	83-1000-25
33A	Solenoid Coil 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		X	83-1000-26	83-1000-26	83-1000-26
33B	Solenoid Coil 208 V, 60 Hz	1		X	X		X	83-1000-65	83-1000-65	83-1000-65
33C	Solenoid Coil 24 V, 60 Hz	1		X	X		X	83-1000-28	83-1000-28	83-1000-28
34	Gasket, Seal Cap ①	1	X	X	X	X	X	81-1001-79	81-1001-79	81-1001-79
35	Seal Cap	1	X	X	X	X	X	24-1137-00K	24-1137-00K	24-1137-00K

① Included in "O" Ring and Gasket Replacement Kit Part No. 24-0168-01K for Range A/D

② Included Diaphragm-Gasket Replacement Kit Part No. 24-0166-00K

③ 35% reduced capacity Main Valve Assembly available as standard on A7A1 and A7A1S. Replacement kit number is 24-0113-01K.

One suggested procedure for setting an evaporator pressure regulator is: Turn Adjusting Stem all the way out (counter-clockwise), allowing the regulator to open wide. Operate the refrigeration system to bring the cooled medium almost down to temperature. Gradually turn the Adjusting Stem in (clockwise) until the evaporator pressure rises to the desired point. Final adjustment will normally be required after the system has run through several complete cycles.

MANUAL OPENING

All A7 Series Regulators can be manually opened during system operation. Type A7A Regulator is manually opened using the following procedure: (Refer to drawing on Page 3)

Loosen Seal Nut (#2)—except on "L" variations which have a Seal Cap (#27) to remove—and turn Adjusting Stem (#1 or #1A) out (counter-clockwise) counting turns until the regulator stays open. To return to normal operation, turn adjusting stem in (clockwise) the same counted number of turns. Adjust final pressure using a pressure gauge. Always tighten lock nut (or seal cap) after adjustment.

Type A7A1 Regulators use a manual by-pass to open the main valve. The operation is as follows: (Refer to drawing on Page 5) Remove Seal Cap (#35) and turn by-pass stem out (counter-clockwise) until the regulator opens (normally, one turn is sufficient to throw main valve wide open). The refrigerant is allowed to bypass the regulator pilot section and feed pressure directly to the top of the piston (passageway "R"), thereby opening the main valve. To return to automatic operation, turn bypass stem in (clockwise) until it seats tightly. Always replace seal cap after adjustment.

Type A72 Regulators use a manual opening stem to push the main valve off its seat. The operation is as follows: (Refer to drawing on Page 7) Remove Seal Cap (#23) and turn Manual Opening Stem (#26) in (clockwise) until the stem contacts the Power Disc and Stem Assembly (#9) and pushes the Main Valve Assembly (#28) off its seat. To return to automatic operation, turn stem out (counter-clockwise) until stem backseats against Valve Cover (#27). Always replace seal cap after adjustment.

PRINCIPLES OF OPERATION

Starting with a closed regulator and an inlet (evaporator) pressure initially below the set-for pressure, the operation of the valve is as follows:

The inlet pressure flows through passage N to the lower side of #10 or #14 Diaphragm in Chamber P. As the inlet pressure rises, the Diaphragm exerts a force upward against #5 or #15 Diaphragm Spring. As the inlet pressure rises above the set-for pressure (determined by the position of Adjusting Stem), the Diaphragm rises from the Pilot Seat, permitting pressure from Chamber P to enter Chamber G on top of #9 or #17 Power Disc and gradually opening the #18 or #28 Main Valve Assembly against #11 or #19 Valve Closing Spring to keep the inlet pressure down to the set-for pressure.

Whenever the inlet pressure drops below the set-for pressure, the Diaphragm moves downward to close the Pilot Seat passage. As the pressure in Chamber G escapes around the Power Disc to the downstream side of the regulator, the Valve Closing Spring gradually returns the Main Valve Assembly toward the closed position. Refrigerant flow is thereby reduced and the inlet (evaporator) pressure is brought back up to the set-for pressure.

When the Pilot Electric Shut-off variation (A7AS, A7A1S or A72S) is used, the flow of pilot gas is routed from the valve inlet through the pilot solenoid valve before entering Chamber P under #10 or #14 Diaphragm. As long as the normally closed solenoid valve is energized (open), the pilot gas flow is uninterrupted and normal regulator operation occurs as described above. When the solenoid valve is de-energized (closed), the flow of pilot gas is interrupted and the regulator closes. Just as with solenoid valves, however, the pilot electric shut-off cannot prevent backward flow through the regulator if the outlet pressure sufficiently exceeds the inlet pressure.

The Electric Wide-opening variation (A7A1, A7A1B and A72B) operates, generally, in a manner opposite to that of the Electric Shut-off variation. When the pilot solenoid valve is de-energized, the valve is regulating at its set-for pressure. Energization of the solenoid allows inlet pressure to flow directly into Chamber G causing the main valve assembly to go wide open.

The Differential Pressure variation (A7A1, A7A1L and A72L) controls the difference between inlet pressure and the external pressure (usually outlet pressure) connected to a ¼" SAE flare fitting in the bonnet.

The Electric Wide-opening and Differential Pressure variations are combined in Types A7A1BL and A72BL. With the pilot solenoid energized the Main Valve Assembly is in the wide open position. When de-energized, the valve is regulating difference between inlet pressure and the external pressure connected to the Valve Bonnet.

SERVICE POINTERS

Symptom	Probable Cause	Correction
Failure to open, close or regulate properly.	Power disc jammed due to excessive dirt.	Clean power disc and regulator body.
	Valve manually open (A7A1, A72)	Close manual bypass (A7A1) Turn manual opening stem out (counter-clockwise) (A72)
	Adjusting stem improperly positioned: a. Turned in too far—does not open. b. Not turned in far enough—does not close.	Position adjusting stem properly.
	Passage N clogged.	Clean passage N.
	Pilot piping obstructed (A72S, A72B or A72BL).	Clean pilot piping.
	Pilot seat dirty or eroded.	Clean and smooth pilot seat. If diaphragm is removed replace with new gasket and "O" Ring.
	Regulator installed backwards.	Re-install regulator in proper position.
	Cover gasket not properly positioned. (A72 sizes only)	Be sure cutout in gasket is aligned with hole in valve body. (A72 sizes)
System control can not be maintained.	Improper Regulator selection: a. Actual load is much lower than regulator capacity. b. Actual pressure drop across valve higher than design. c. Combinations of a and b.	Replace with s regulator.

SAFE OPERATION (See Bulletin RSB)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent product bulletins and the current Bulletin RSB prior to installation or servicing work.

WARRANTY

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from the factory. This warranty is in force only when products are properly installed, maintained and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Division. Defective products, or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection will be replaced or repaired at Refrigerating Specialties' option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt, or other foreign substances will not be considered defective.

THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

AMF

Paragon

RM Series

Installation Instructions

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